HEAD AND NECK

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OBJECTIVES

- Understand the how different imaging modalities depict the head and neck anatomy
- Realize how anatomic depiction of the head and neck can translate into clinical utility
- Identify the anatomy of the orbit in different imaging planes on MRI and CT
- Identify the anatomy of the sinuses on CT and radiographs
- Appreciate the complexity of the Temporal Bone
- Be able to identify the main anatomical structures in the neck on CT, MRI, and barium swallow
- Use imaging to better understand the vascular anatomy of the neck

IMAGING MODALITIES

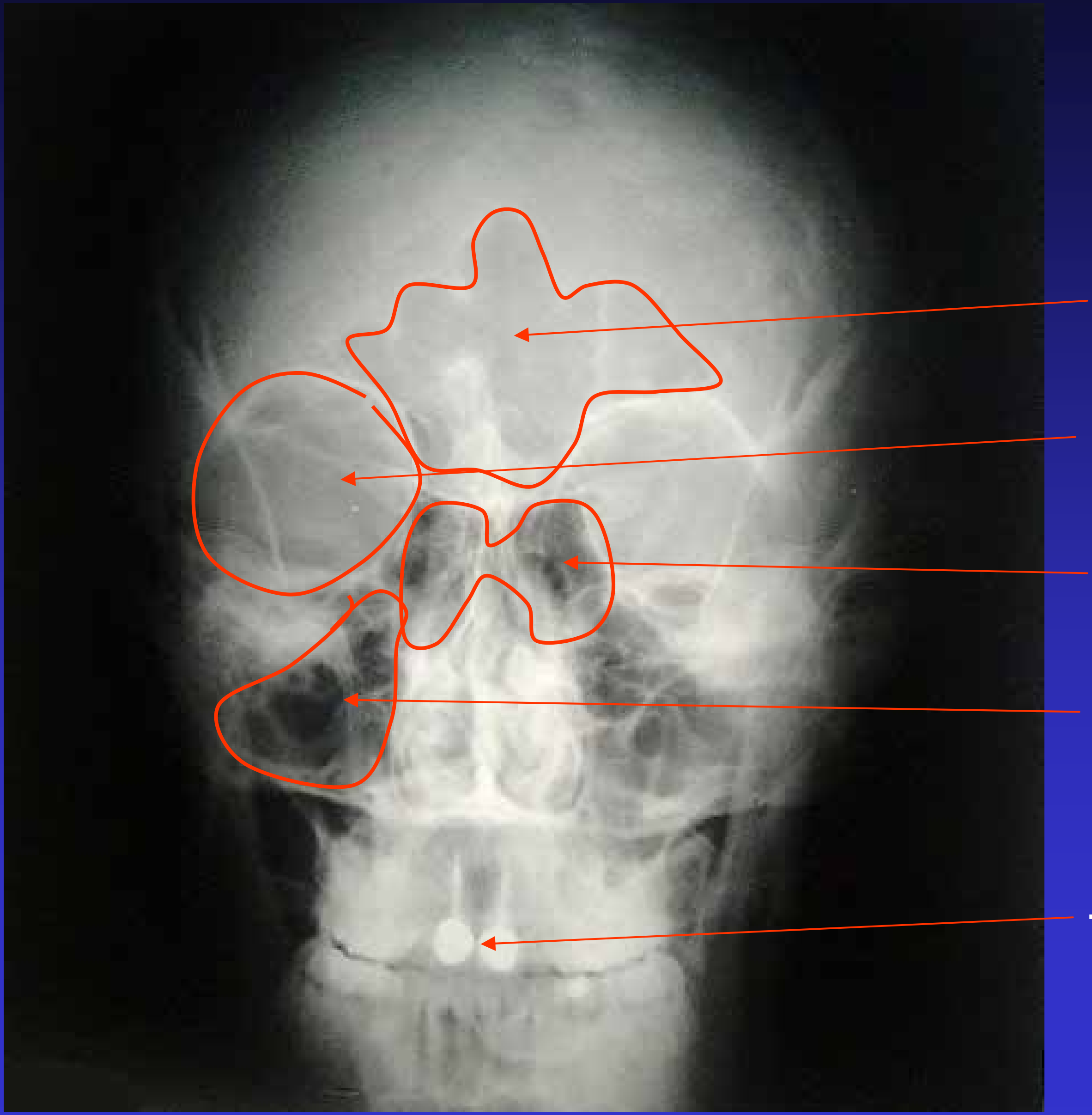
- Radiographs (Xray)
  - Include barium swallow
- Ultrasound
- Nuclear medicine
- Angiography
- Computed Tomography (CT)
  - CT angiography
- Magnetic Resonance Imaging (MRI)
  - MR angiography

SKULL / MAXILLO-FACIAL RADIOGRAPHS

- PA or AP
- Lateral
- Townes
- Waters (My favorite)
- Nasal bones
- Panorex
- Other special views
  - Less used these days with CT
  - Orbits, TM joints, Mandible, etc

Together, these form a skull series

Skull/Face – AP Sinuses



FRONTALS

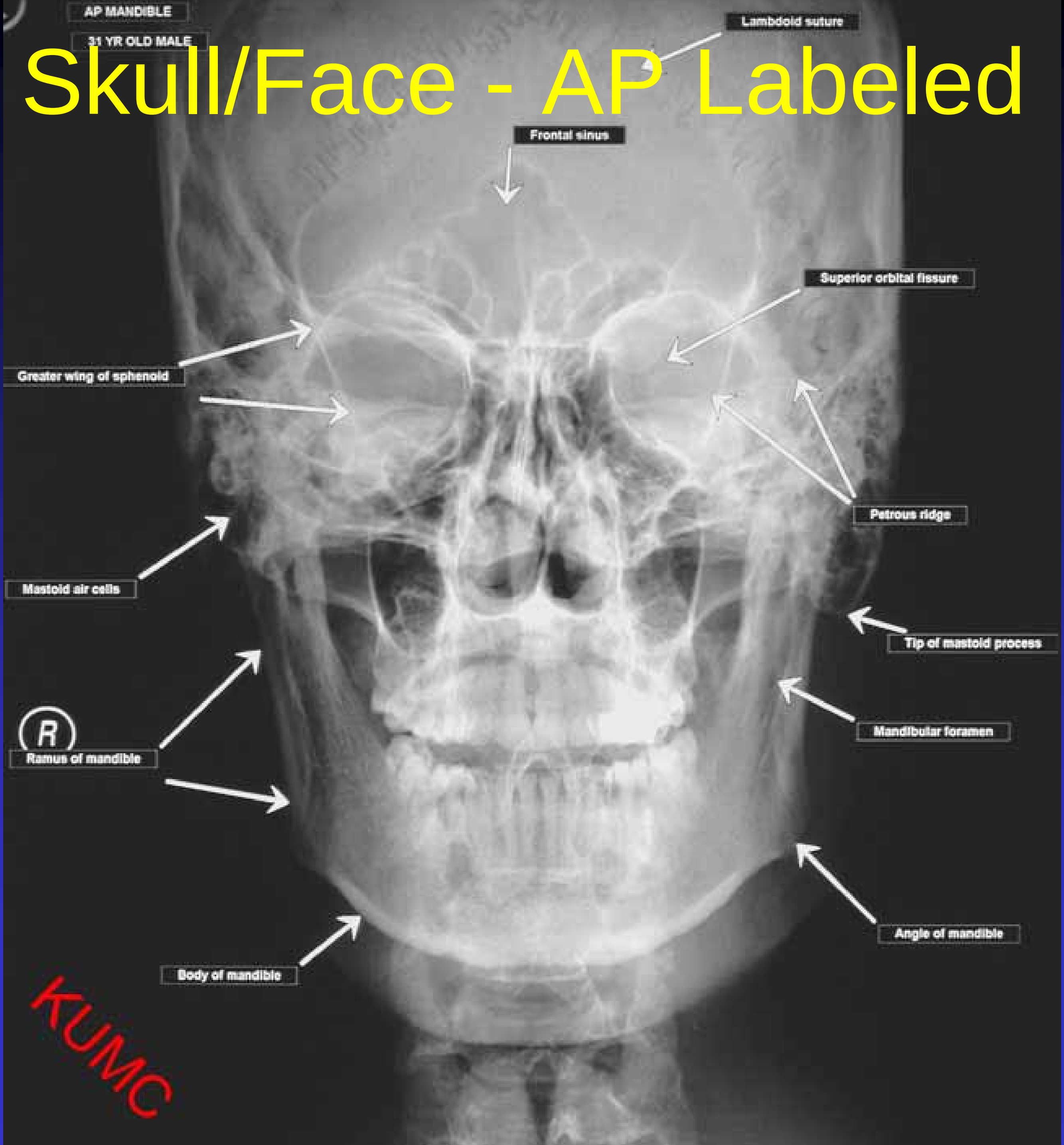
RIGHT ORBIT

ETHMOIDS

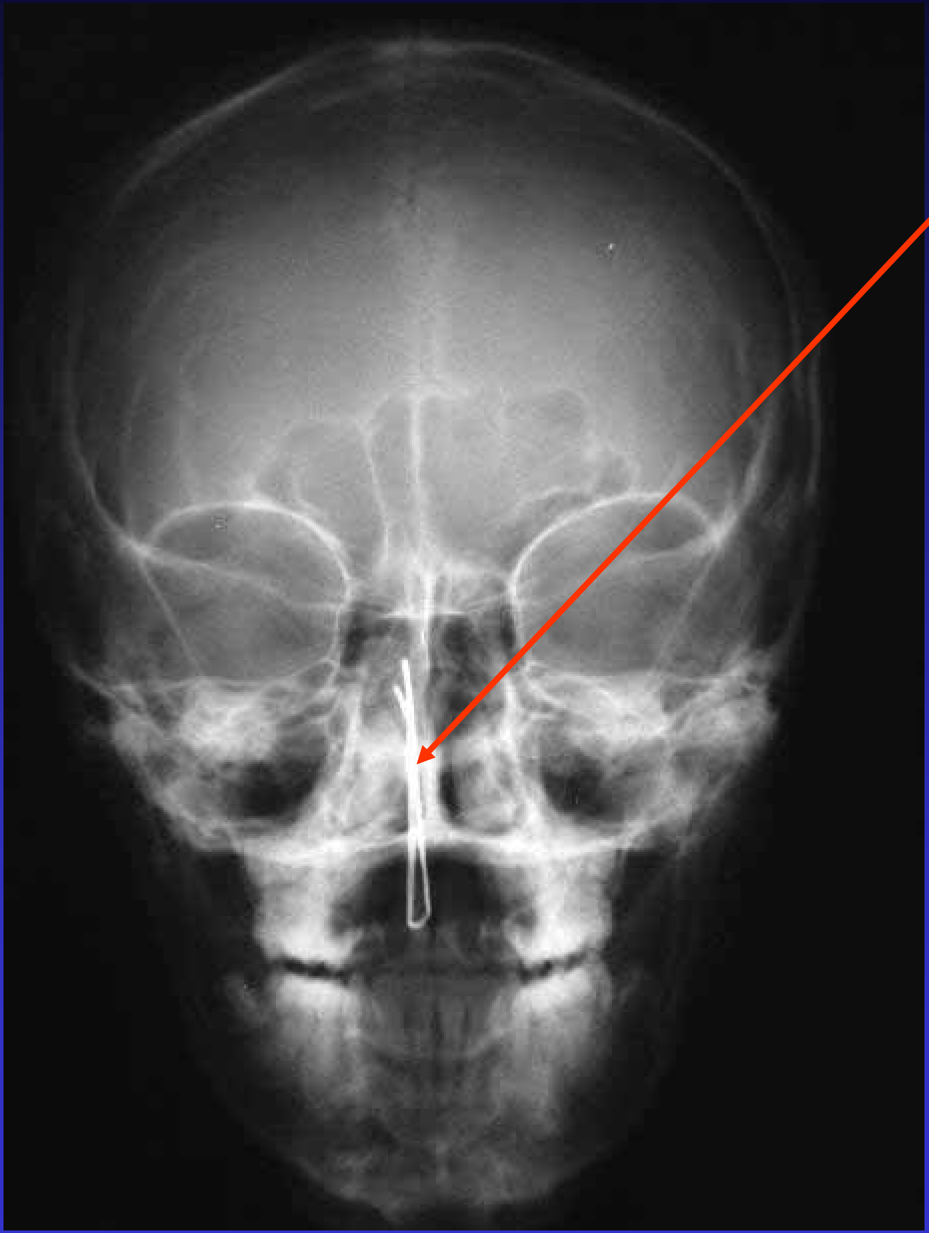
RIGHT MAXILLARY

FILLINGS IN
TEETH 8 AND 9

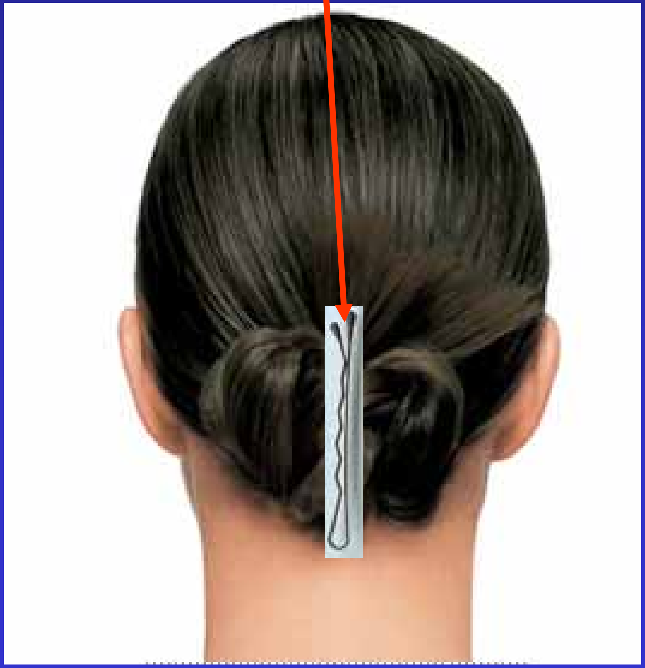
Skull/Face - AP Labeled



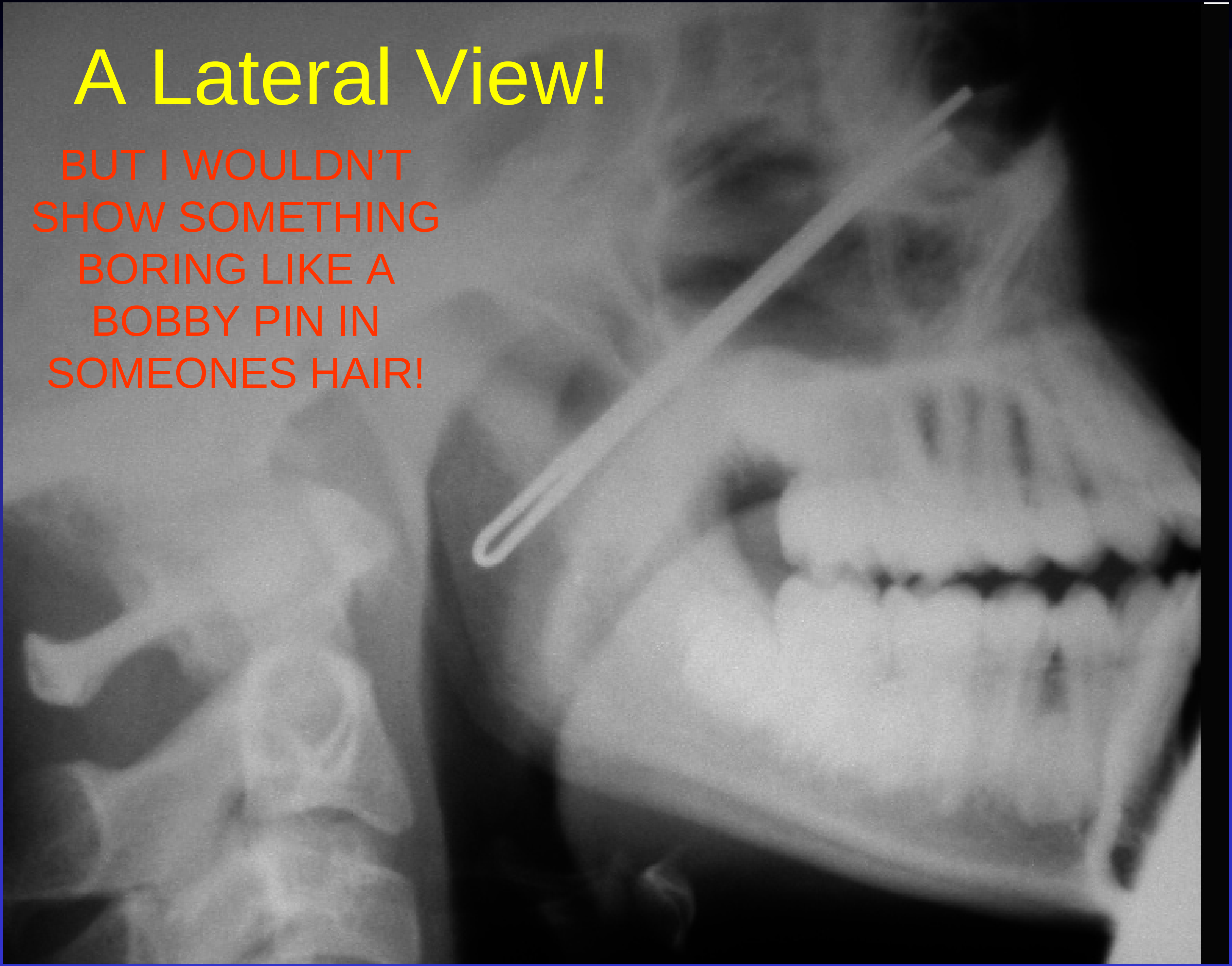
Skull/Face – AP



TO KNOW WHERE THIS IS YOU NEED A ???? VIEW BECAUSE IT COULD JUST BE HERE



A Lateral View!

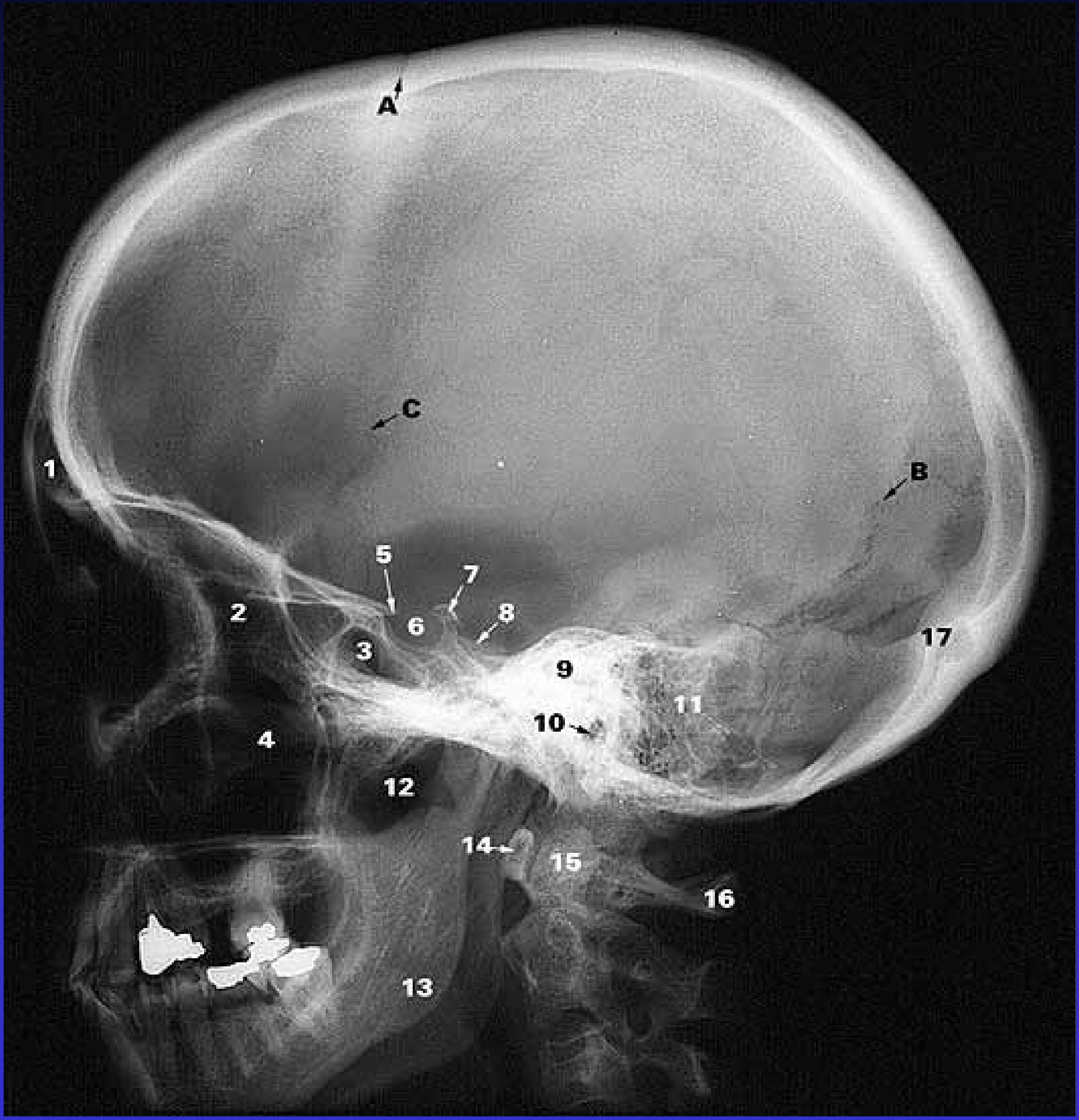


BUT I WOULDN'T SHOW SOMETHING BORING LIKE A BOBBY PIN IN SOMEONES HAIR!

Where Is The Bobby Pin?

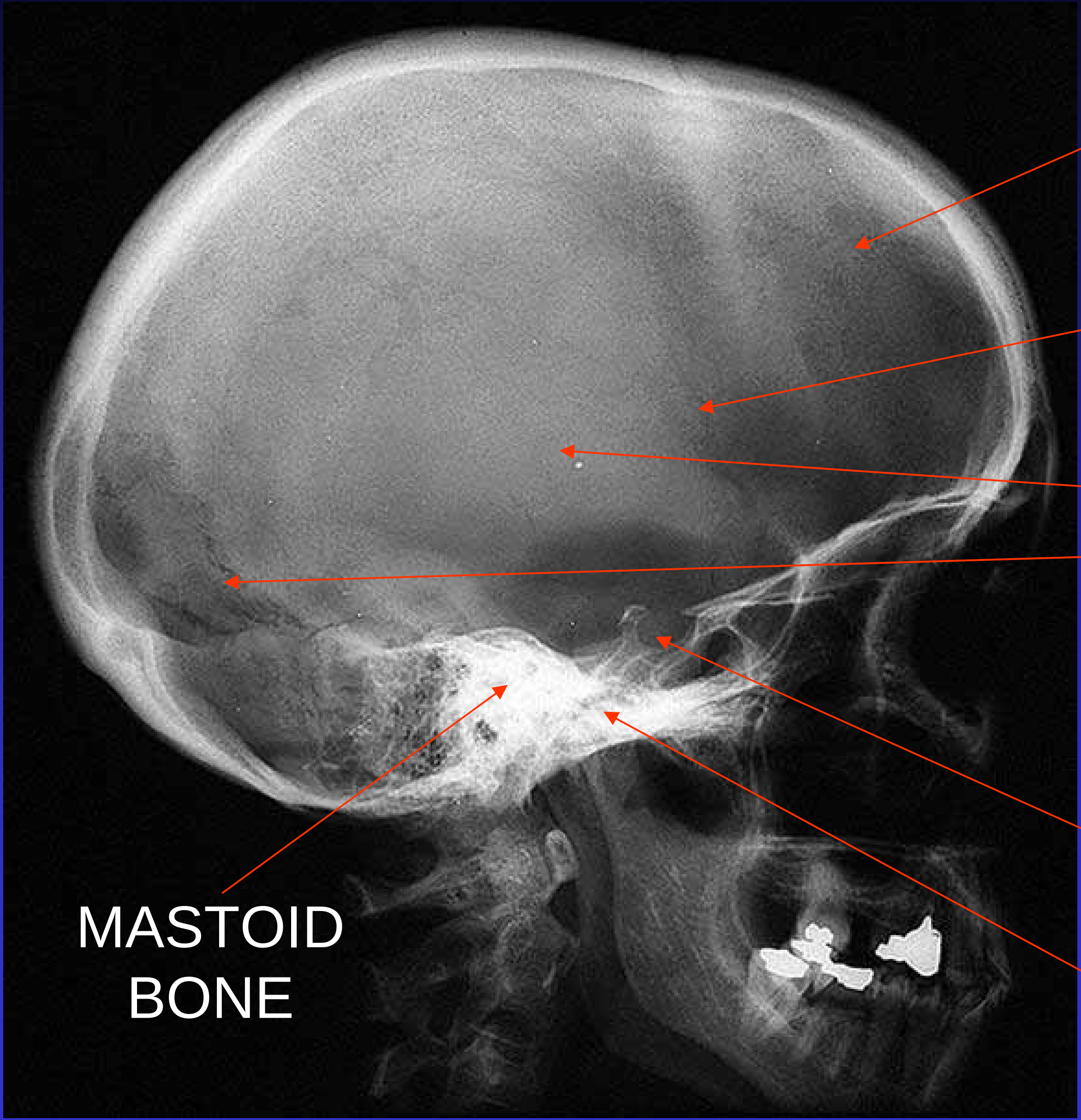
- Right nasal cavity with the tip projecting into the pharynx
- If asked what to do about this???
- The answer is:
  - CALL ENT (at least for the next 4-7 years)

Skull – Lateral



1. Frontal sinus
2. Ethmoid sinus
3. Sphenoid sinus
4. Maxillary sinus
5. Anterior clinoid
6. Sella turcica
7. Posterior clinoid
8. Clivus
9. Petrous portion of temporal bone
10. External acoustic meatus
11. Mastoid air cells
12. Nasopharynx
13. Angle of mandible
17. Internal occipital protuberance
15. Odontoid process
14, 16. Ring of C1
A. Coronal suture
B. Lamdoid suture
C.Grooves of middle meningeal artery

Skull/Face – Lateral



FRONTAL BONE

CORONAL SUTURE

PARIETAL BONE

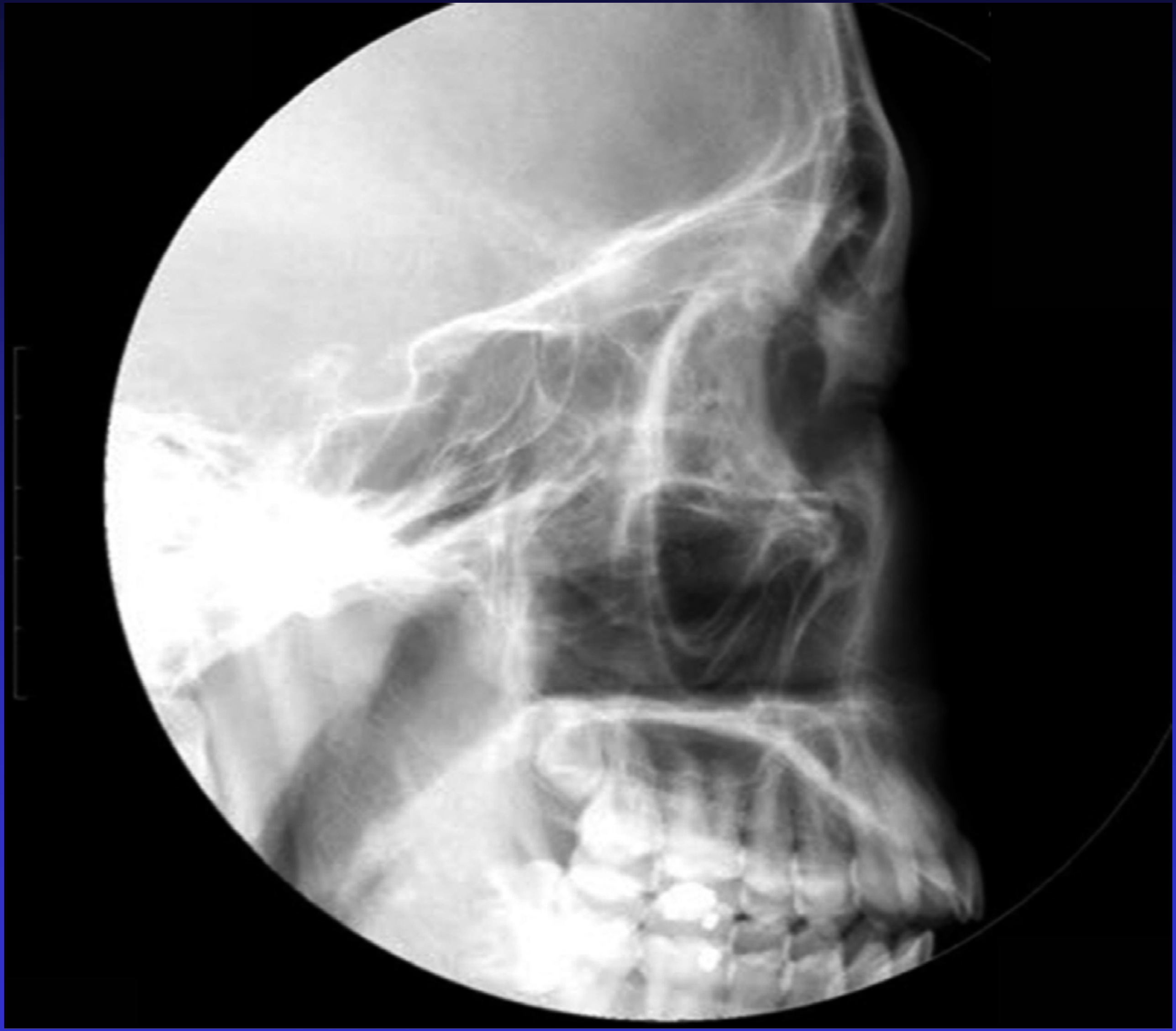
LAMBDOID SUTURE

SELLA TURCICA

TM JOINT

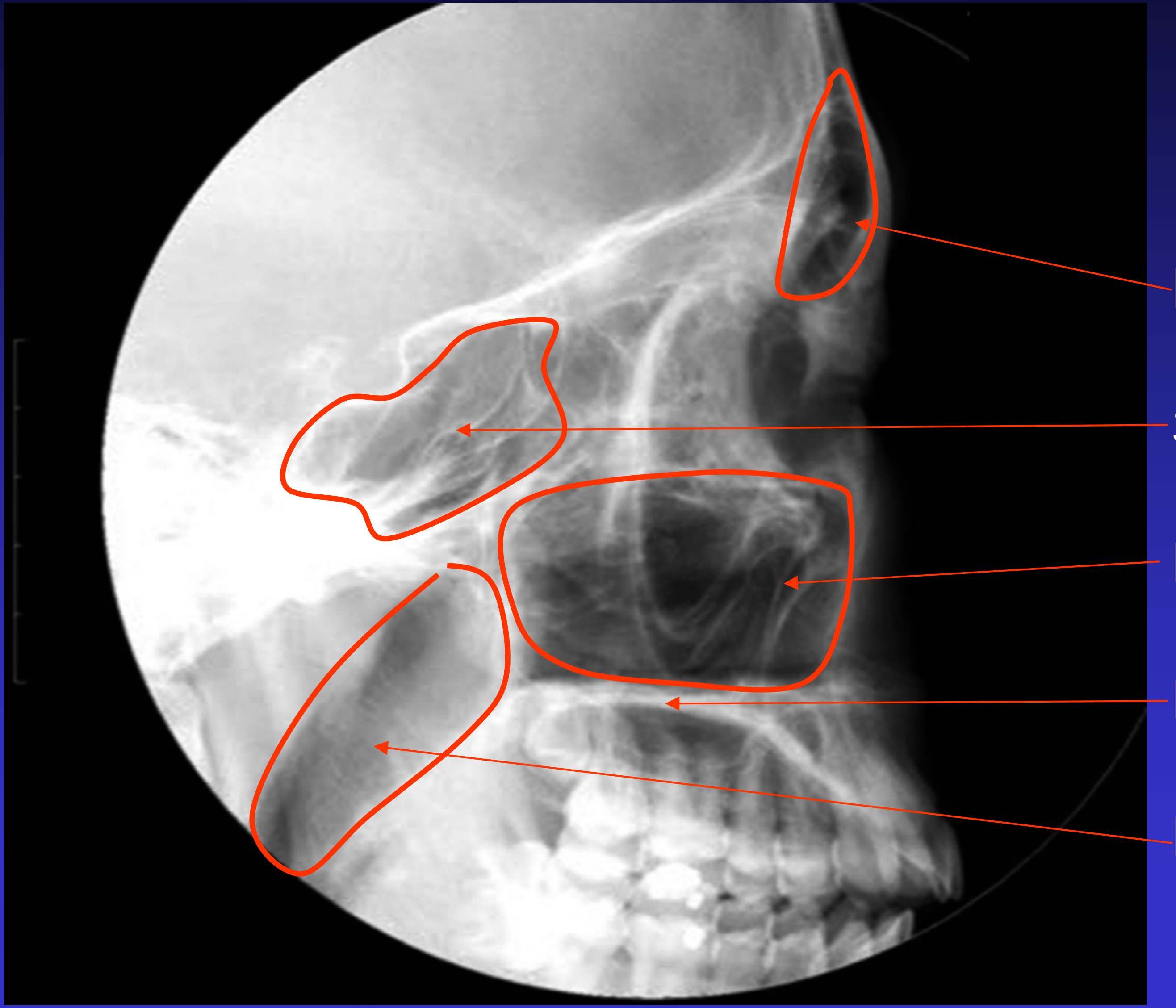
MASTOID BONE

Skull/Face – Lateral



MAGNIFIED
TO SHOW
MAX-FACE
STRUCTURES

Skull/Face – Lateral



FRONTAL

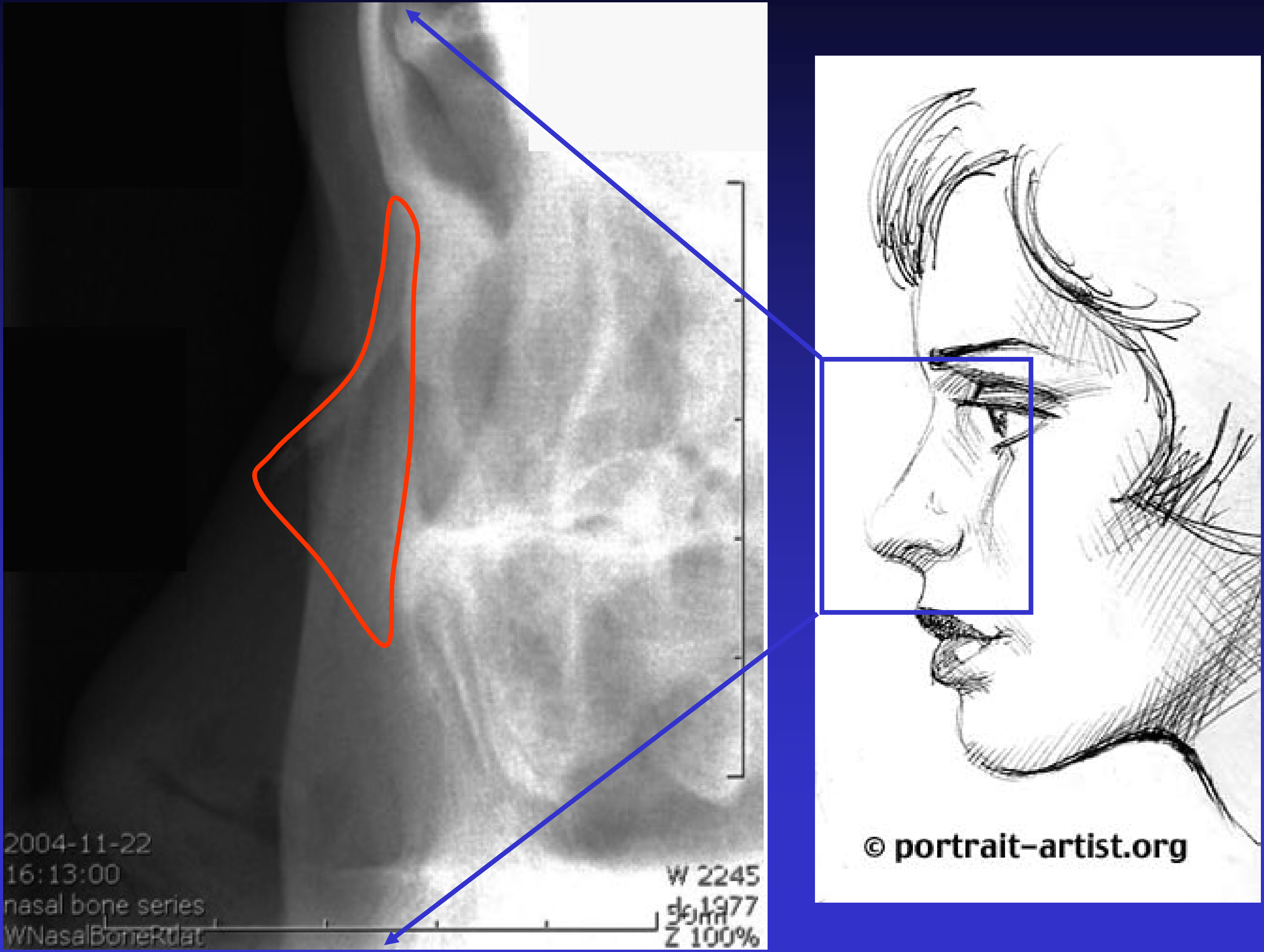
SPHENOID

MAXILLARY

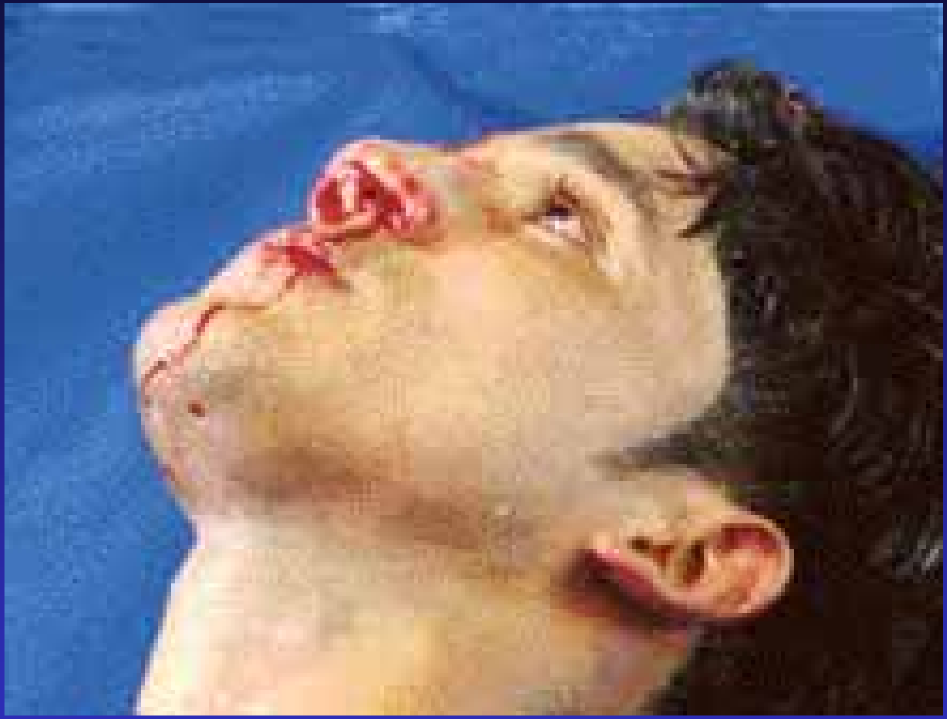
HARD PALETTE

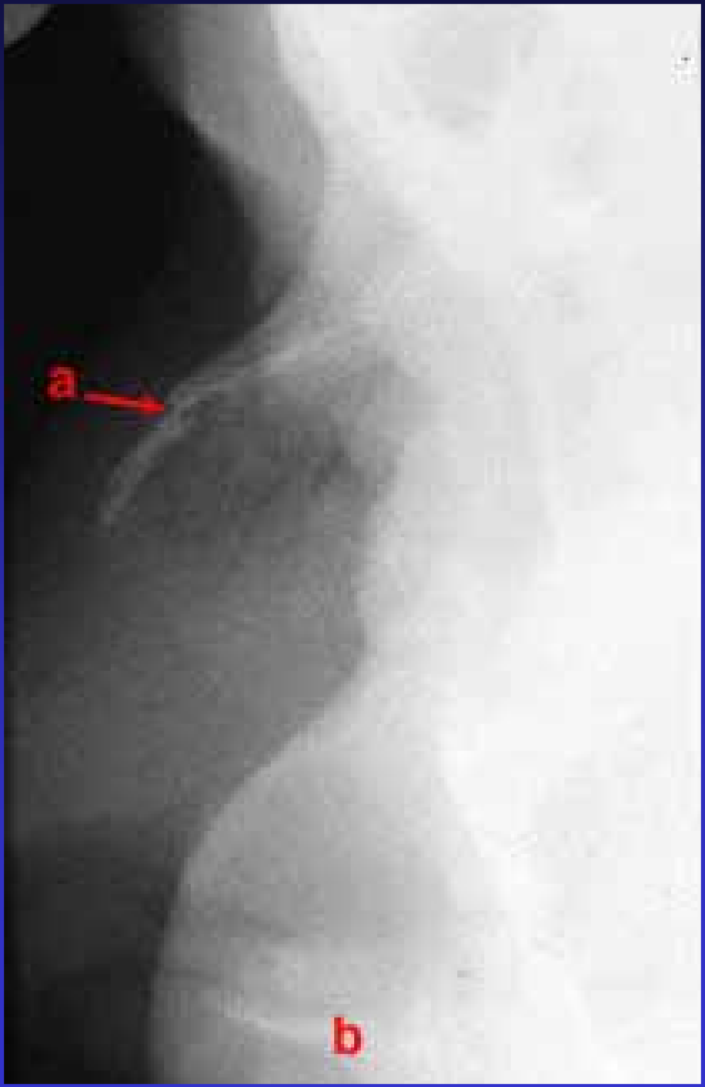
PHARYNX

Nasal Bone – Lateral



Nasal Bone - Fracture

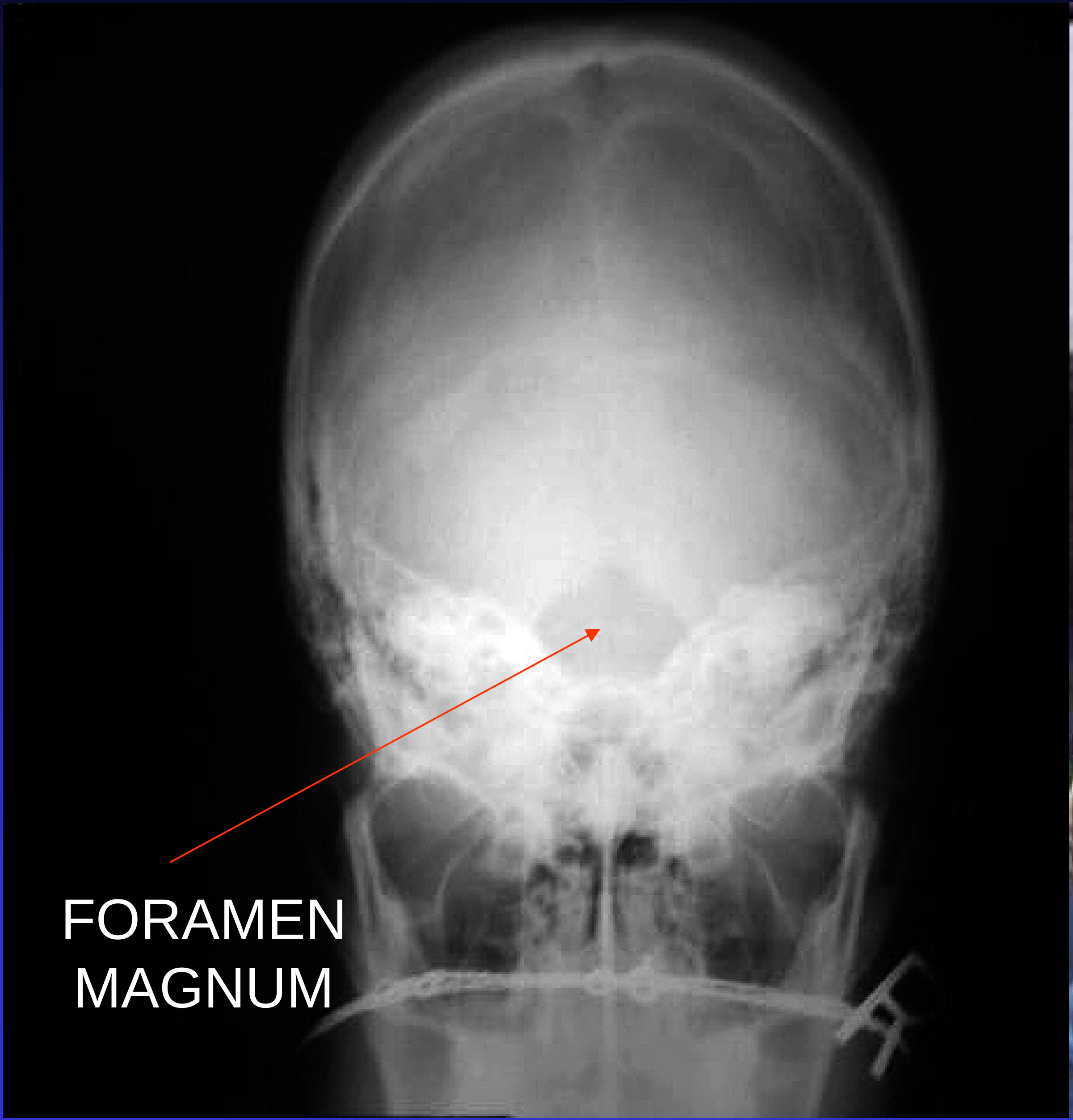




a = FRACTURE OF NASAL BONE

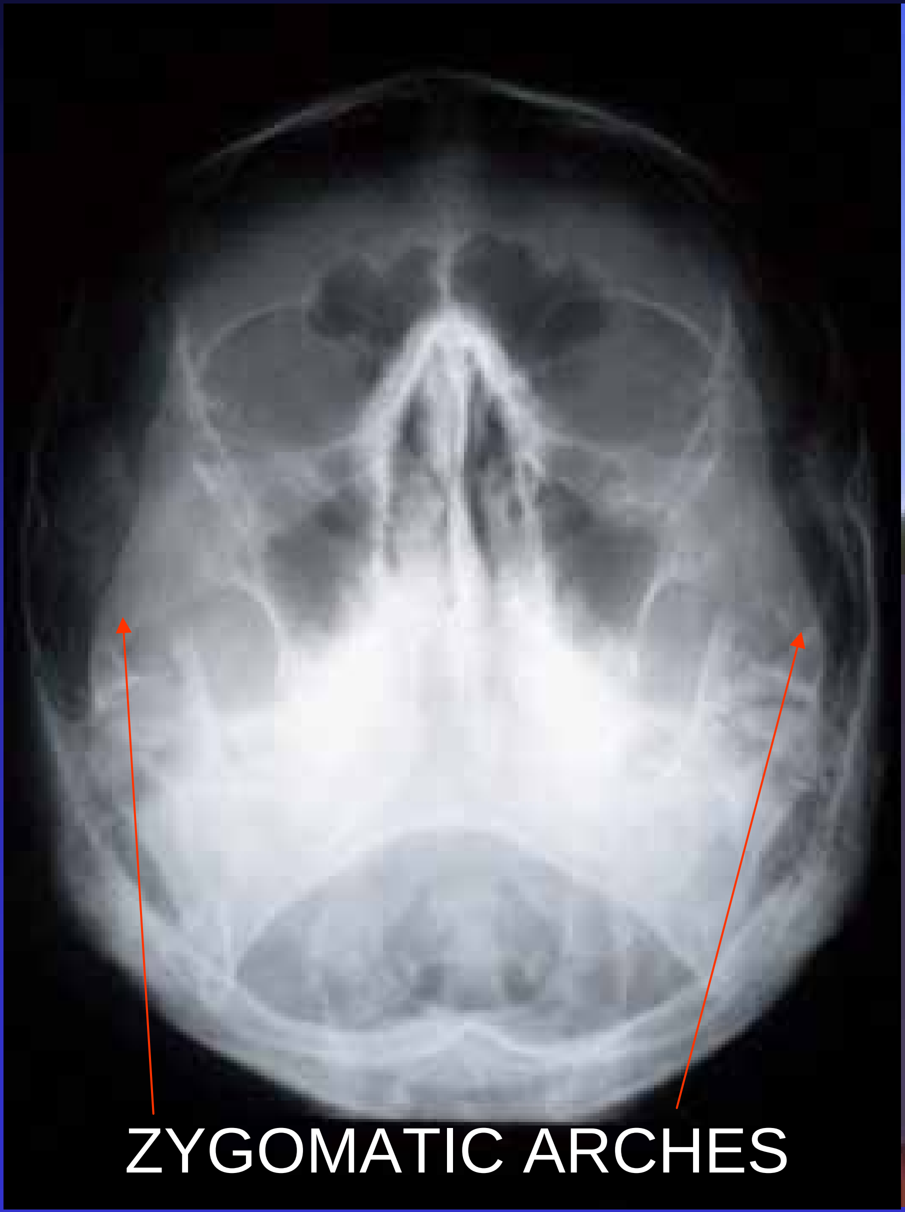
b = NASAL SPINE OF MAXILLA
NOT FRACTURED

Skull/Face – Townes

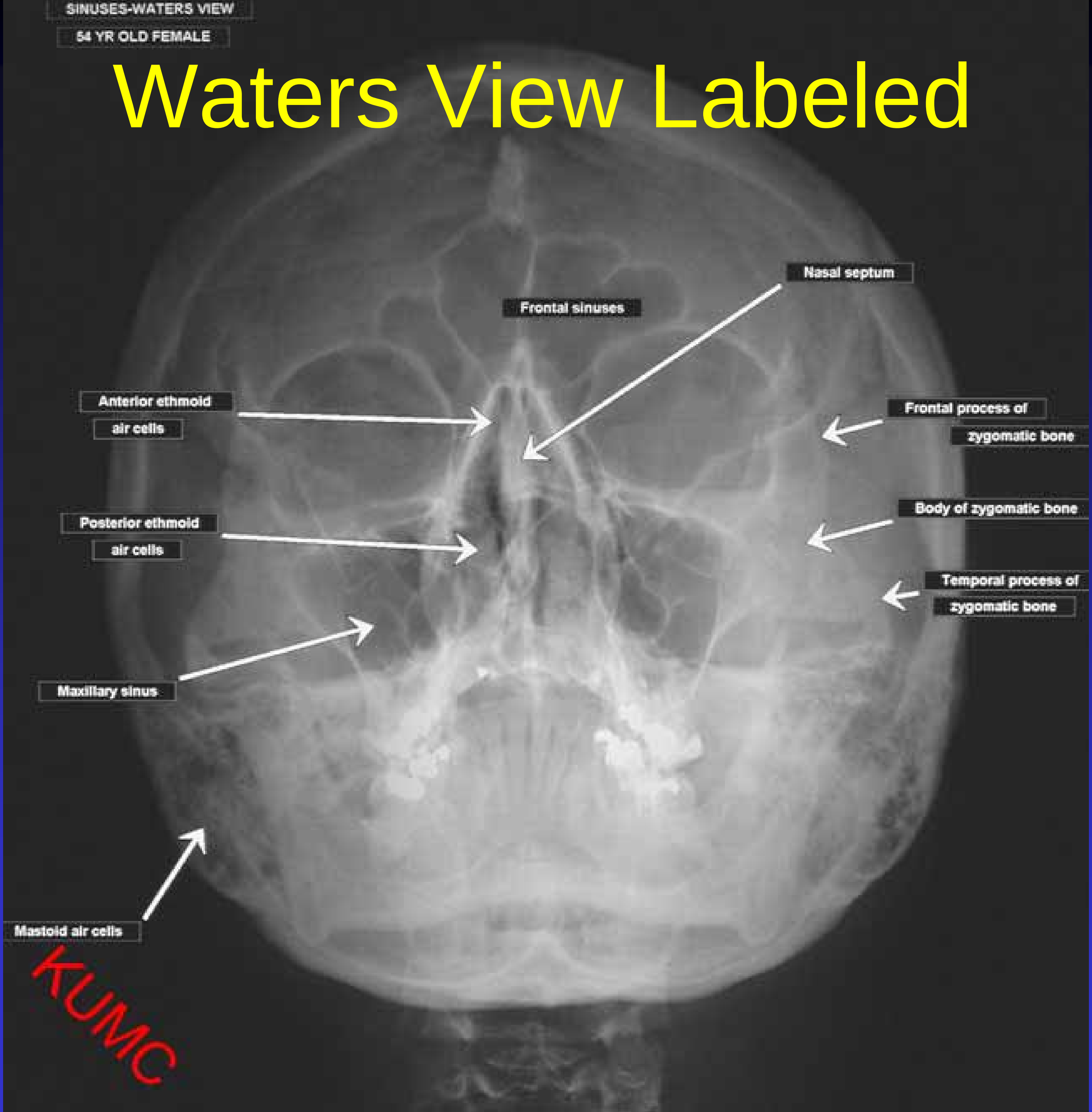


LOOKING DOWN!

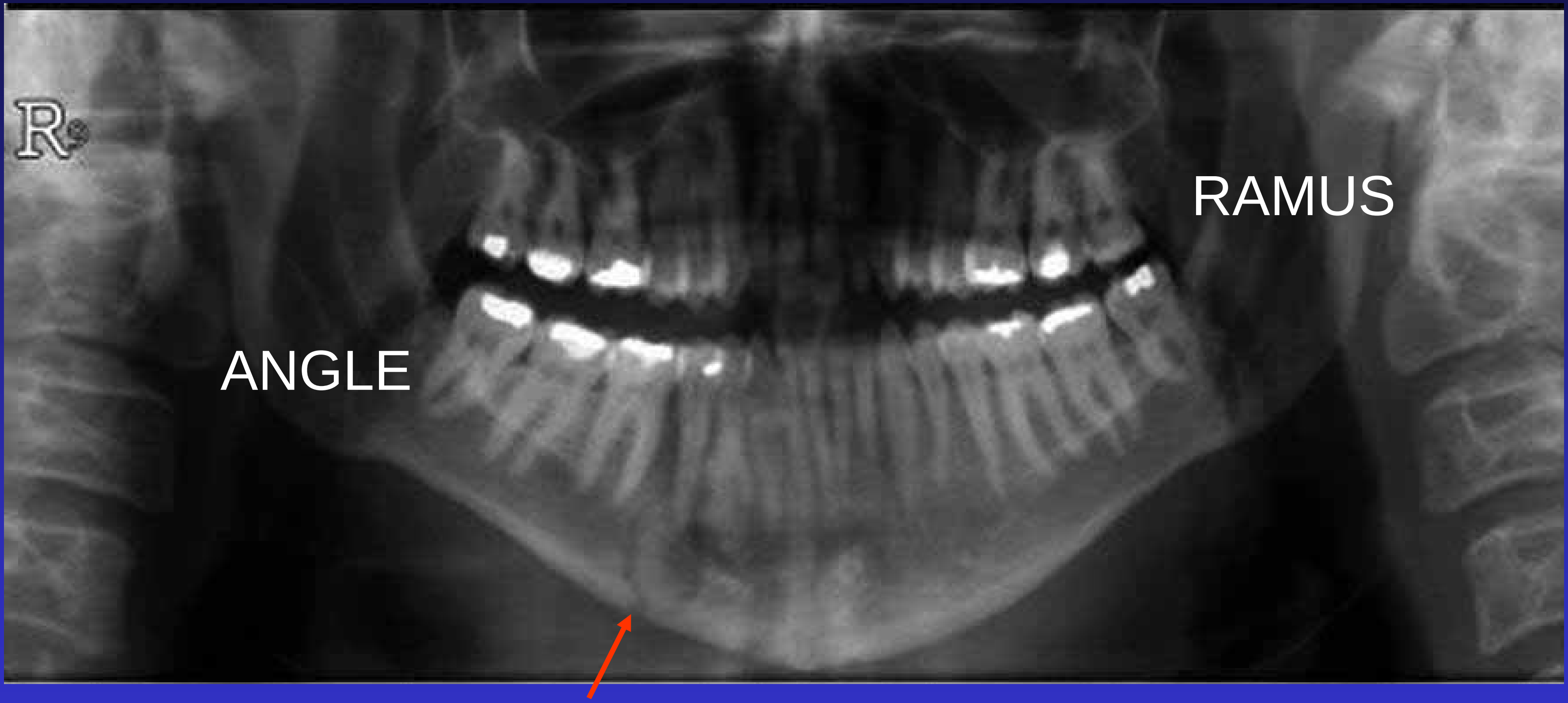
Skull / face – Waters



Waters View Labeled


SINUSES-WATERS VIEW
54 YR OLD FEMALE
Nasal septum
Frontal sinuses
Anterior ethmoid air cells
Frontal process of zygomatic bone
Posterior ethmoid air cells
Body of zygomatic bone
Temporal process of zygomatic bone
Maxillary sinus
Mastoid air cells
KUMC

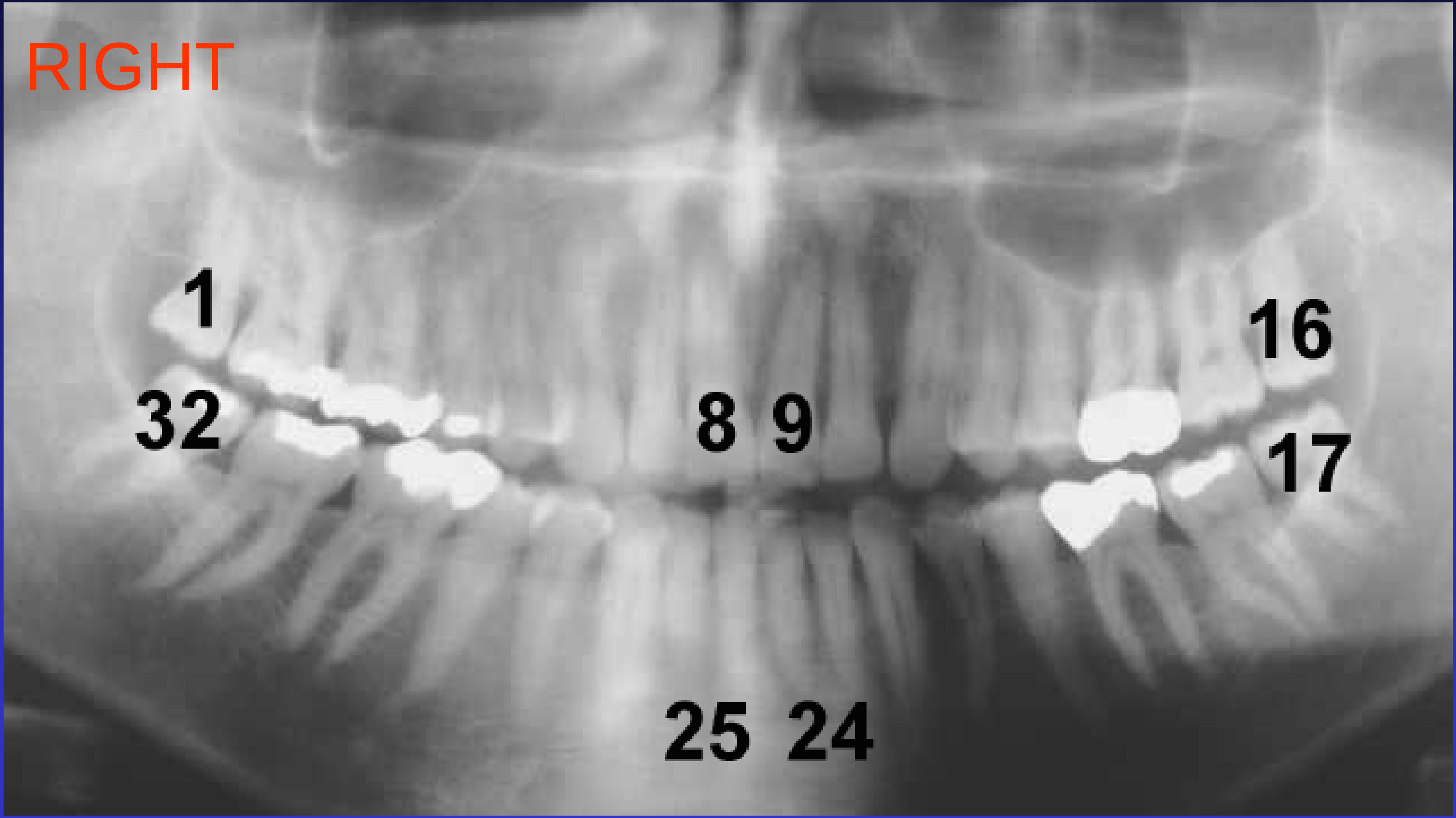
Panorex View



FRACTURE OF BODY OF MANDIBLE

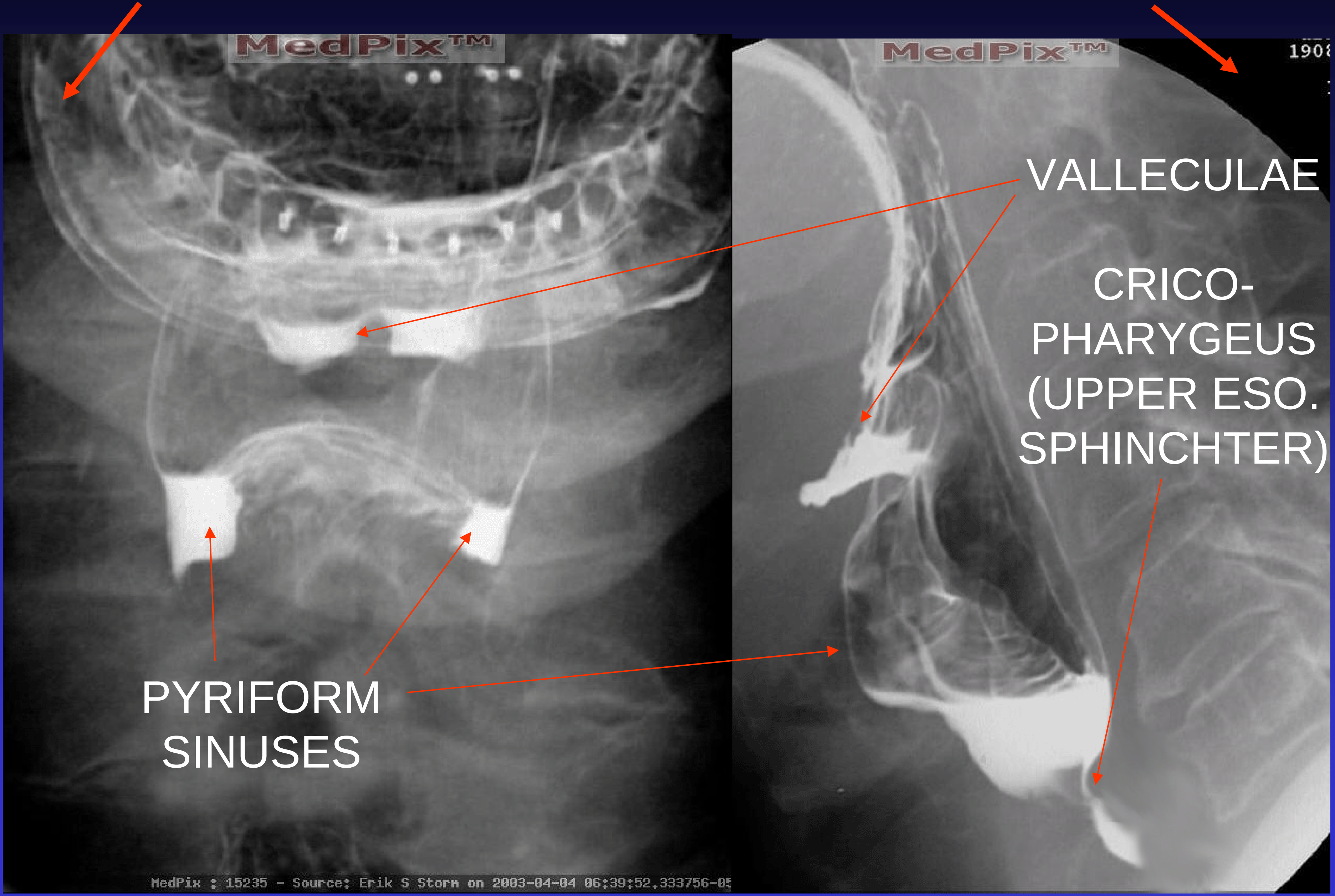
No, this is not Siamese twins joined at the face

Numbering The Teeth



SO NOW YOU KNOW WHAT TO EXPECT WHEN YOUR DENTIST TELLS THE ASSISTANT ‘PT NEEDS ROOT CANALS OF 17 & 18’

AP - Barium Swallow - Lateral



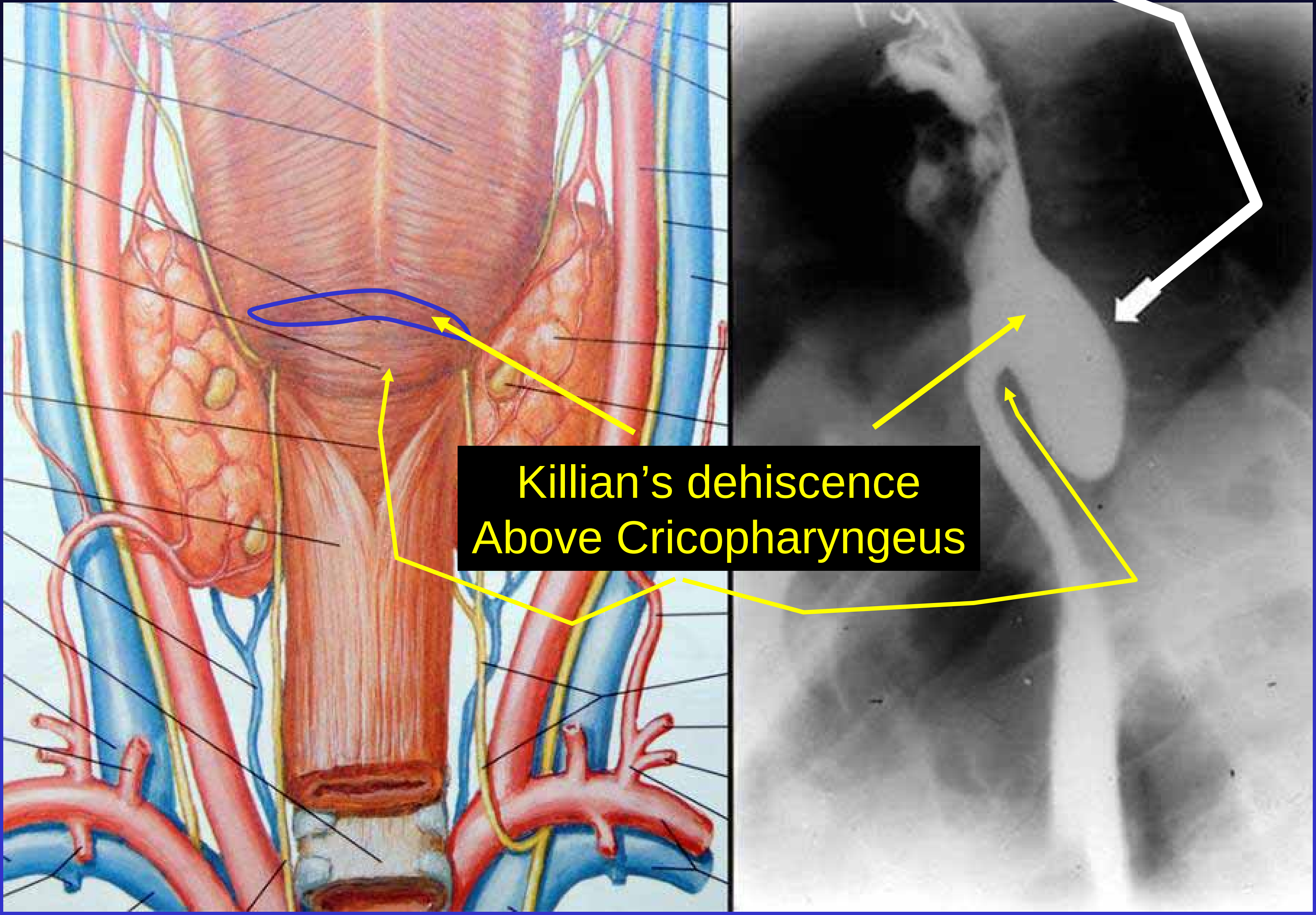
VALLECULAE

CRICO-
PHARYGEUS
(UPPER ESO.
SPHINCHTER)

PYRIFORM
SINUSES

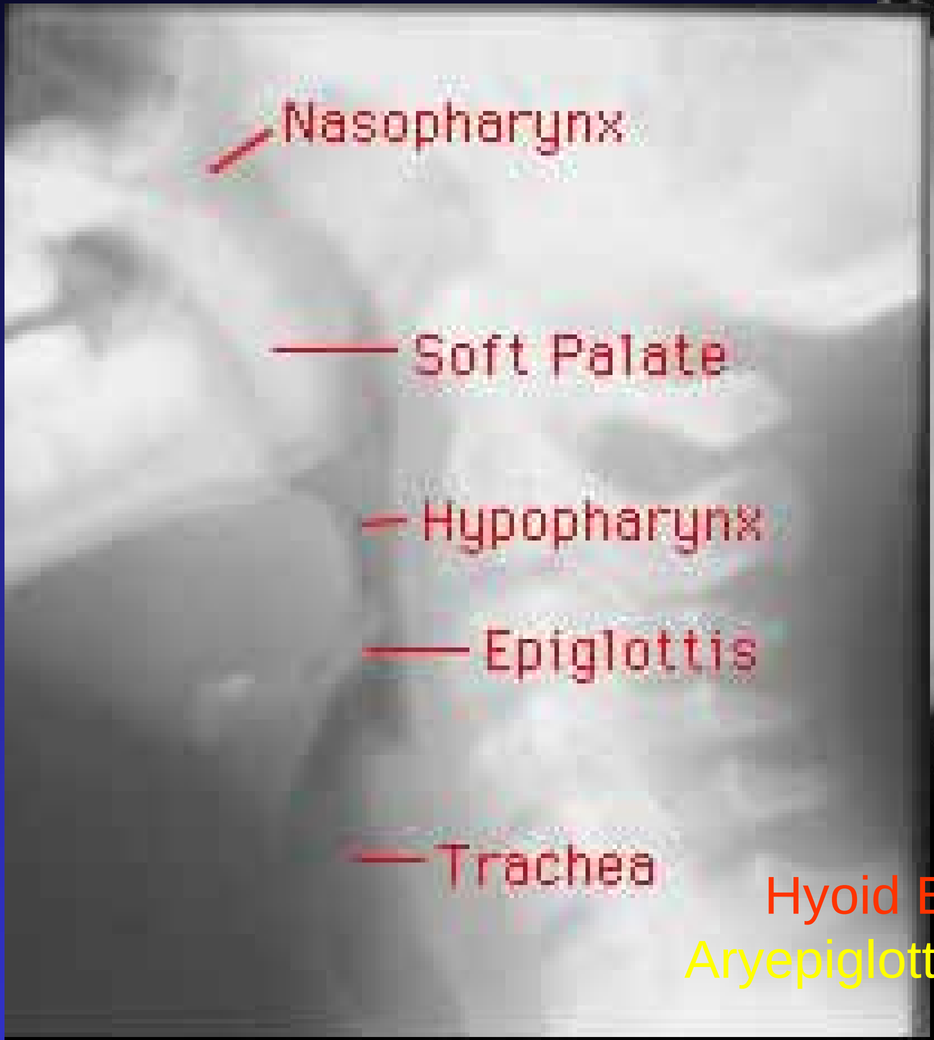
MedPix : 15235 - Source: Erik S Storm on 2003-04-04 06:39:52.333756-0

Zenker Diverticulum

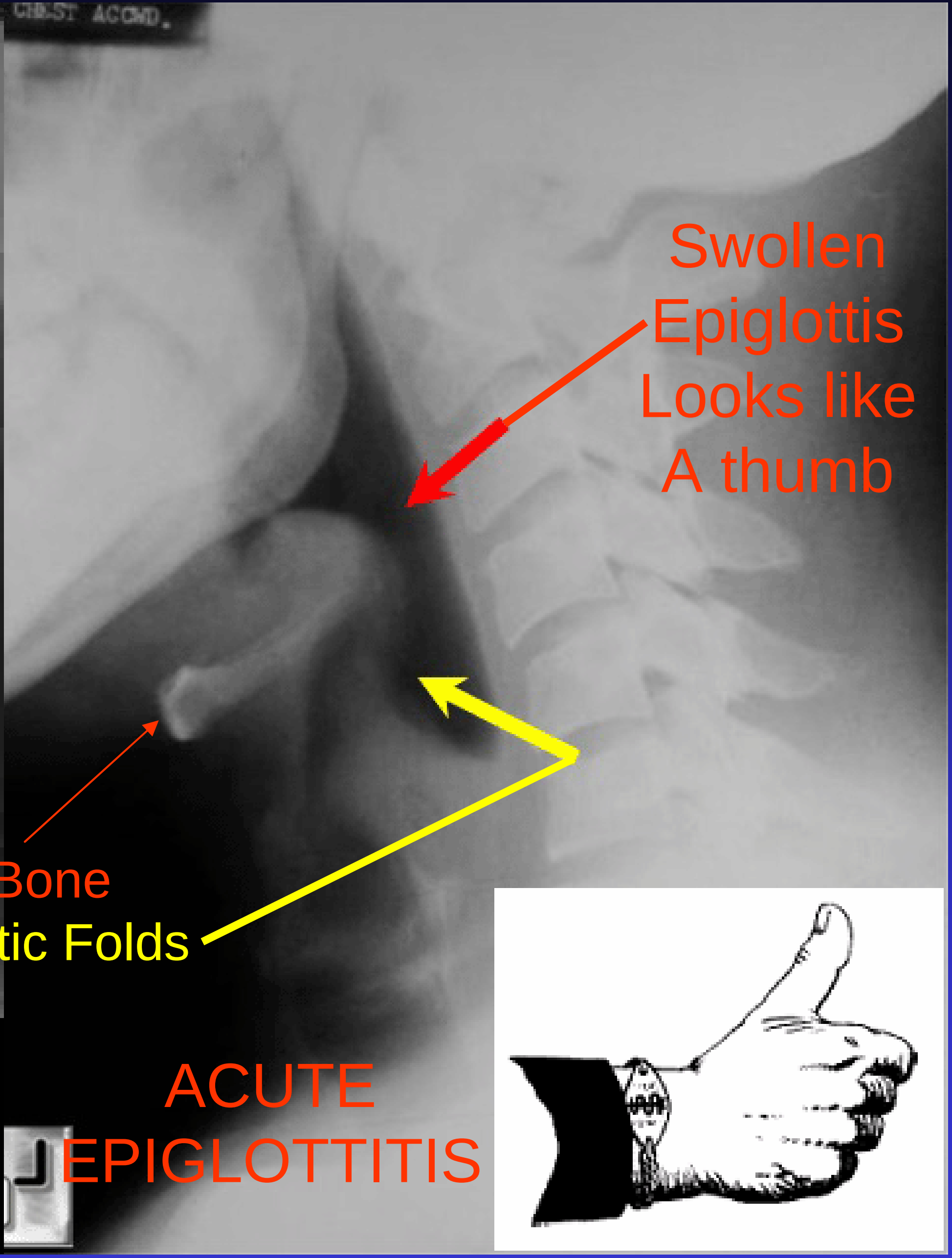


Killian's dehiscence
Above Cricopharyngeus

Neck – Lateral Soft Tissue



Lateral airway x-ray shows normal anatomy. Notice the wafer-thin epiglottis.



Swollen
Epiglottis
Looks like
A thumb

Hyoid Bone

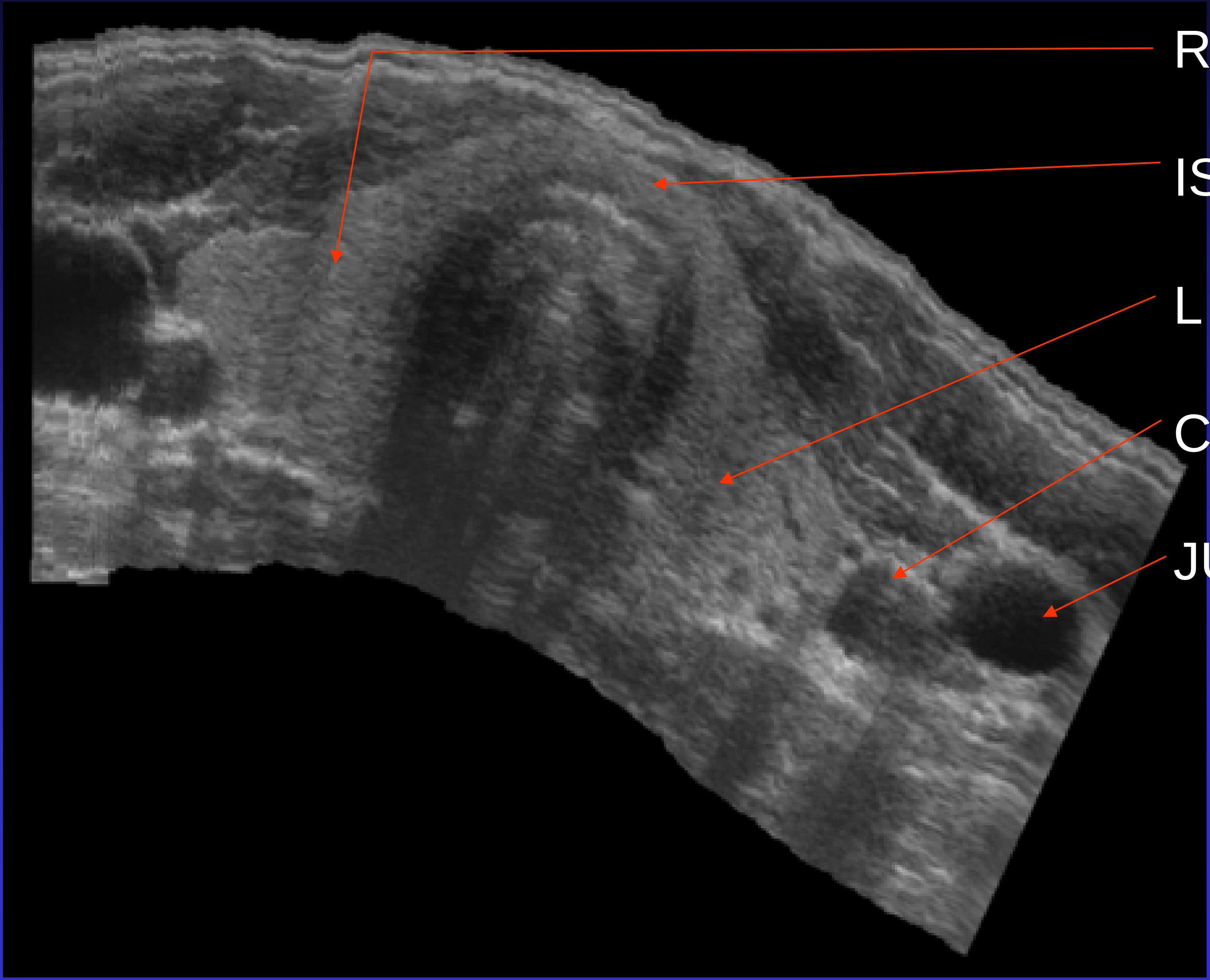
Aryepiglottic Folds

ACUTE
EPIGLOTTITIS

IMAGING MODALITIES

- Radiographs (Xray)
  - Include barium swallow
- Ultrasound
- Nuclear medicine
- Angiography
- Computed Tomography (CT)
  - CT angiography
- Magnetic Resonance Imaging (MRI)
  - MR angiography

Thyroid – Ultrasound Transverse



R LOBE

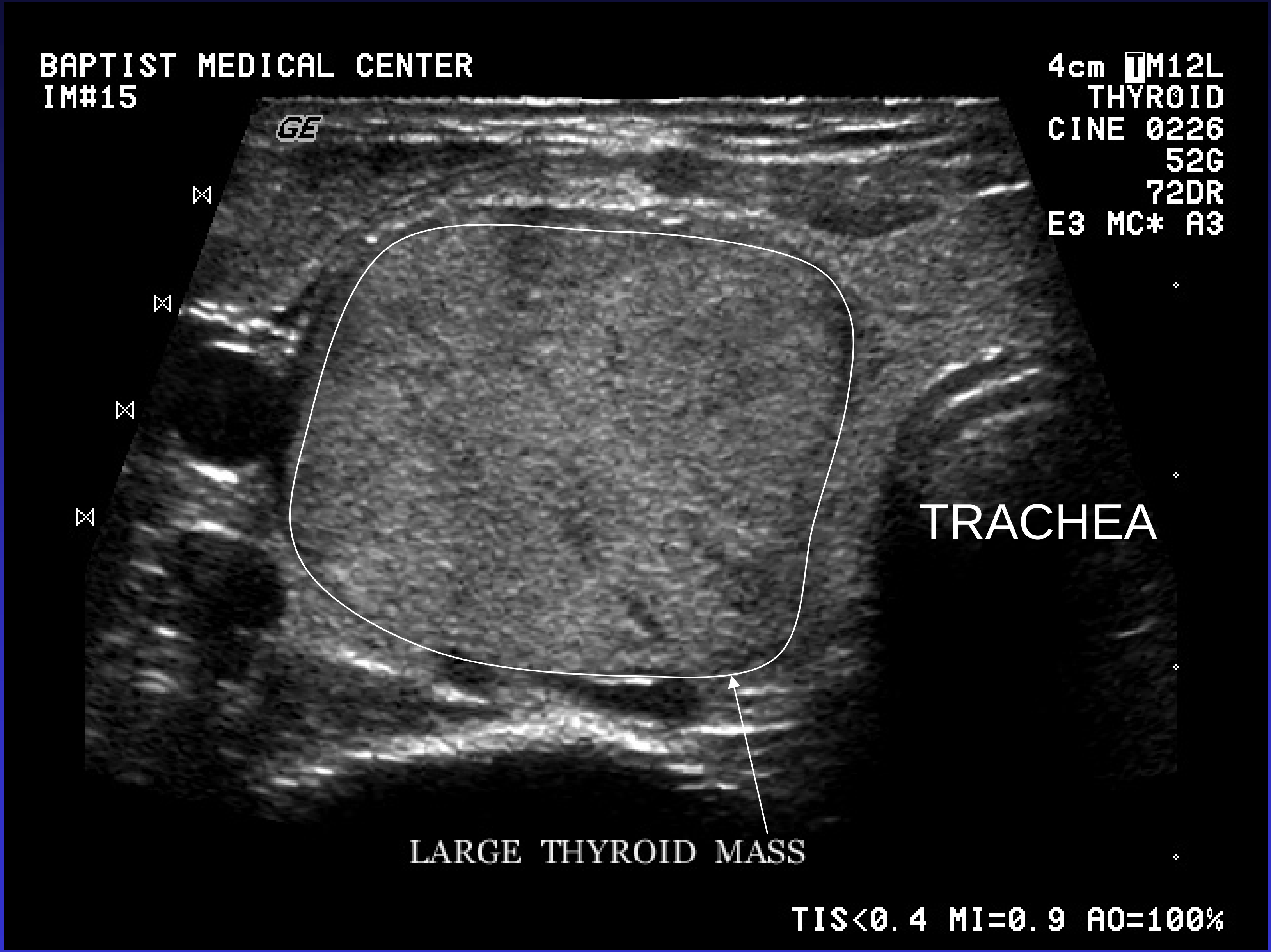
ISTHMUS

L LOBE

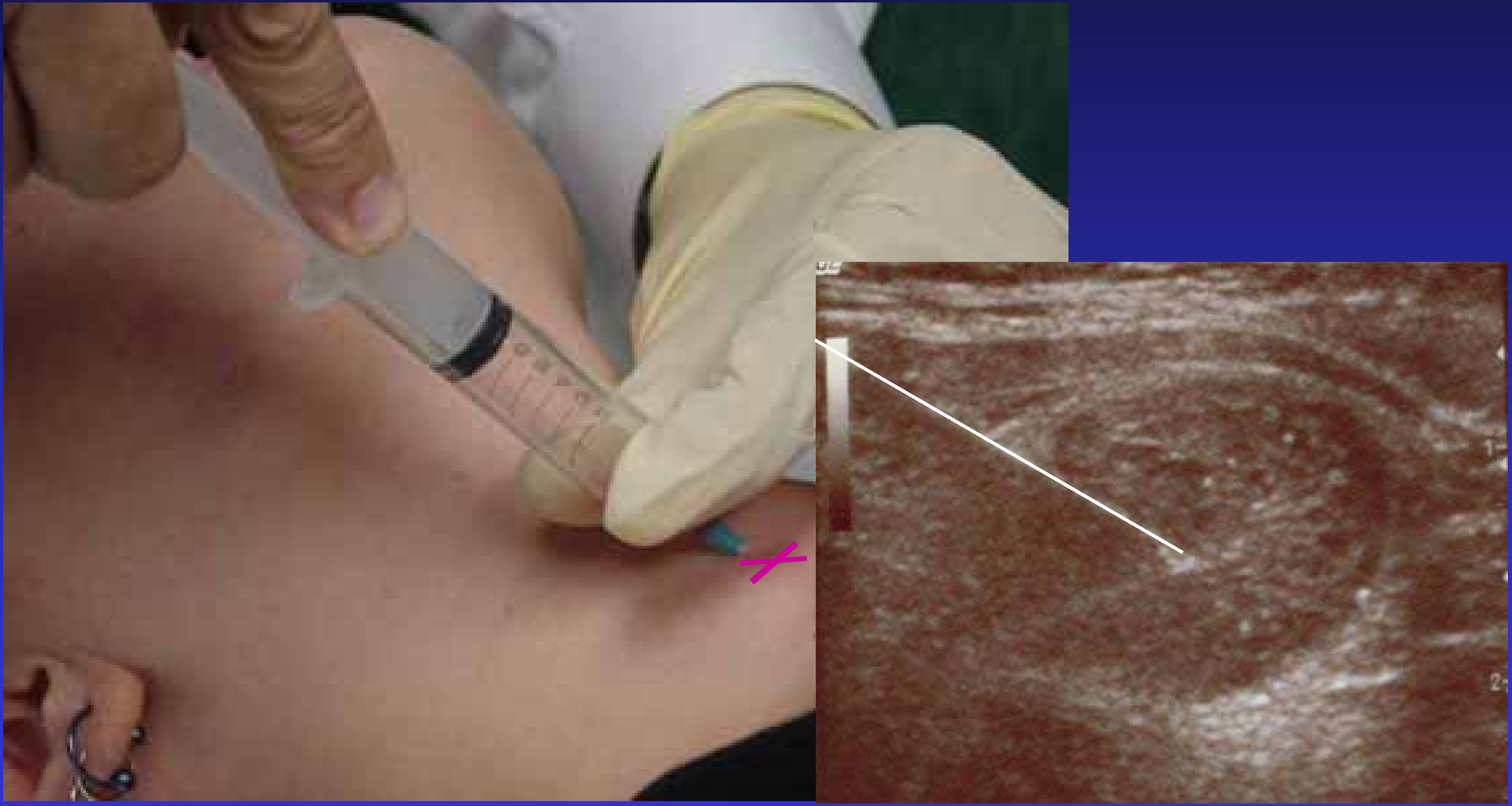
CAROTID ART

JUGULAR V

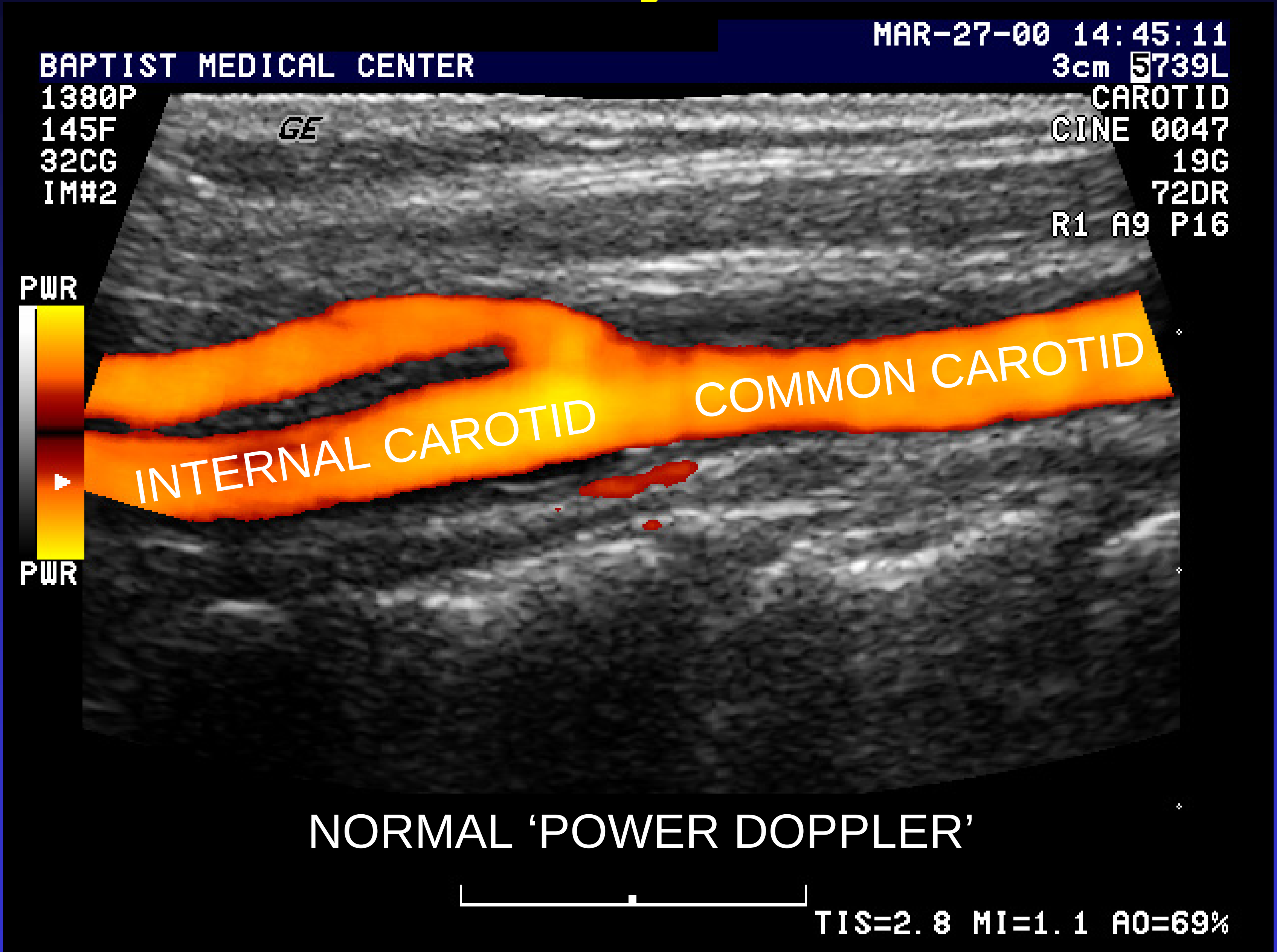
Thyroid – Ultrasound Right



Ultrasound Guides Thyroid Biopsy

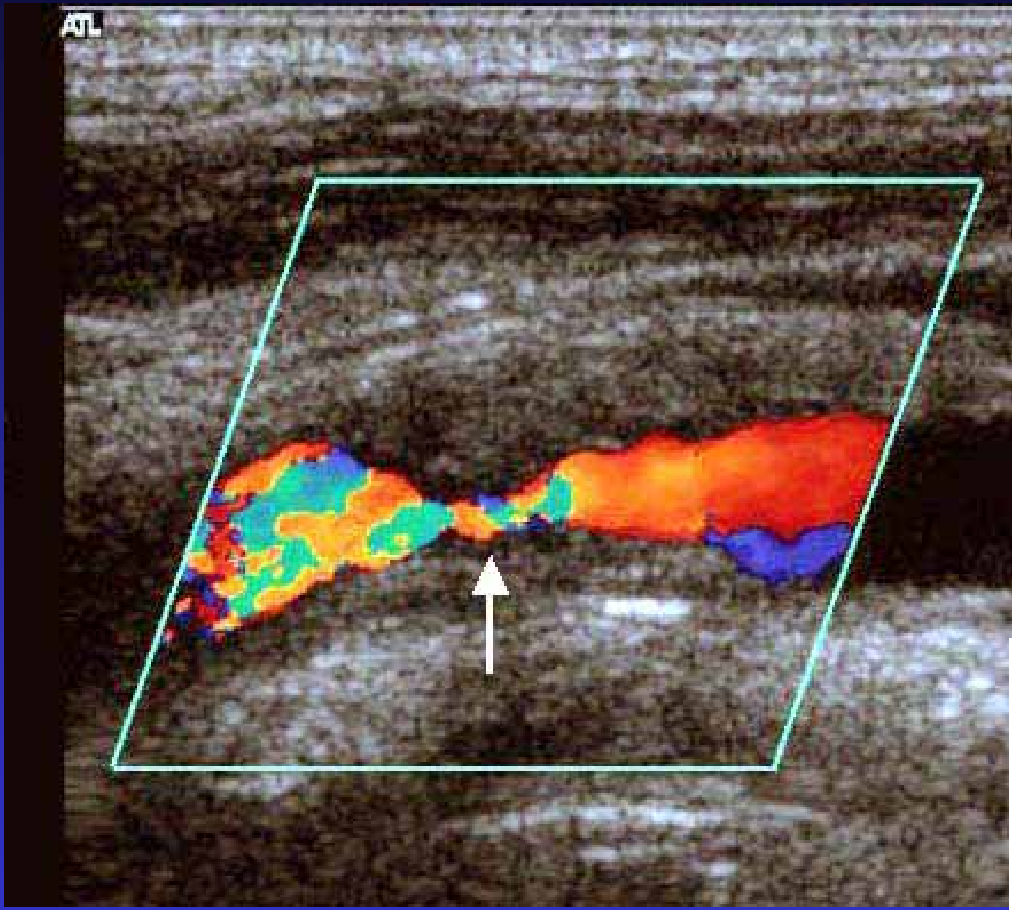


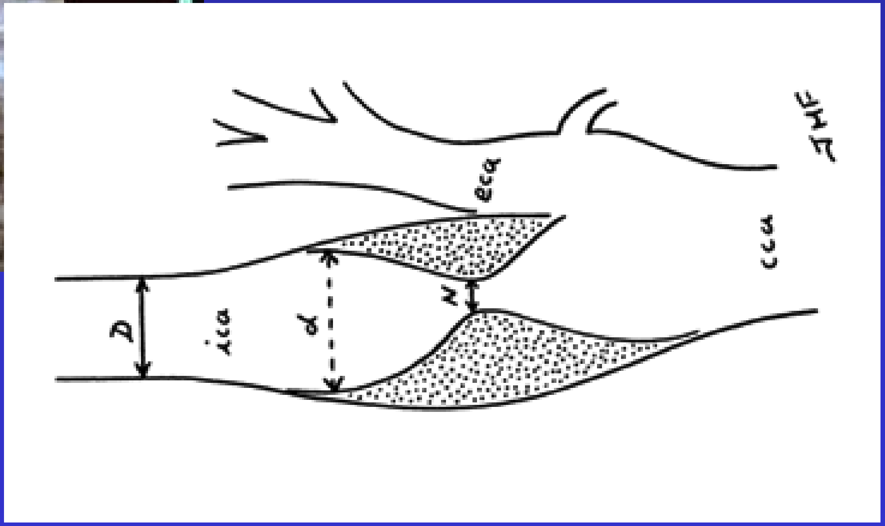
Carotid Artery Ultrasound



NORMAL ‘POWER DOPPLER’

Internal Carotid Stenosis



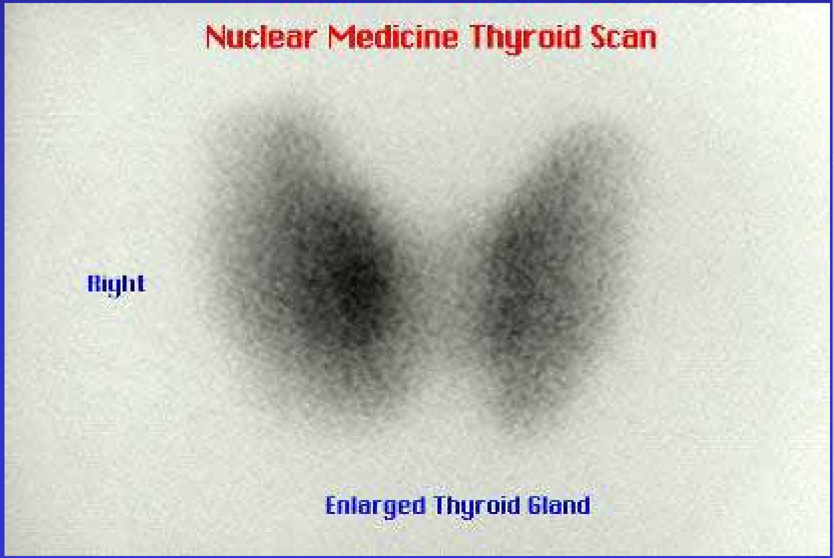


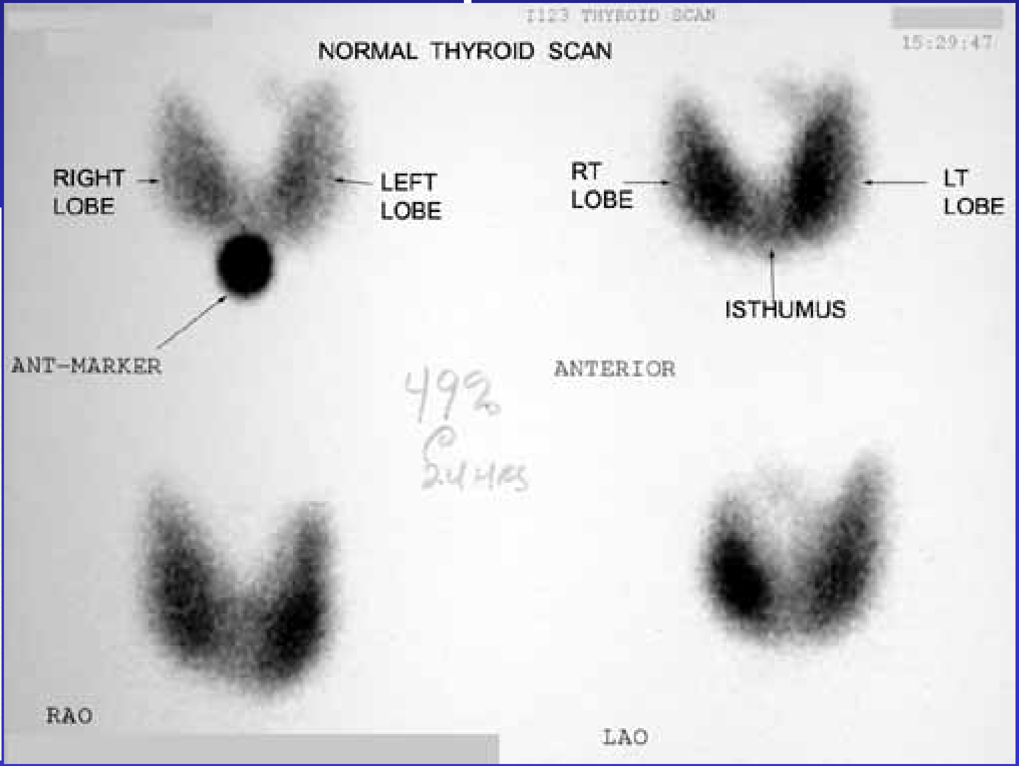
IMAGING MODALITIES

- Radiographs (Xray)
  - Include barium swallow
- Ultrasound
- Nuclear medicine (PET)
- Angiography
- Computed Tomography (CT)
  - CT angiography
- Magnetic Resonance Imaging (MRI)
  - MR angiography

Thyroid Scan – Old Technology

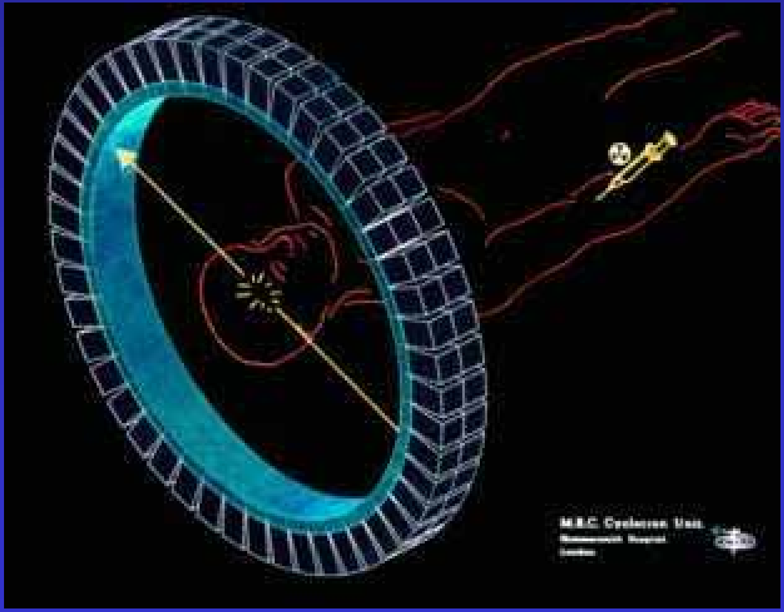
- Inject Iodine radioisotope (I-131, I-123)
  - Also may use Technetium
- Taken up by thyroid
- Equally important to calculate uptake % as to get pictures

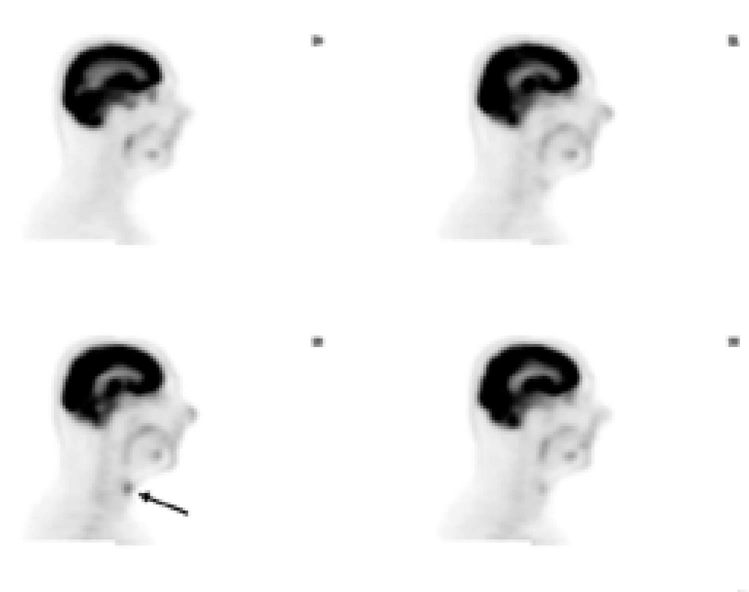




PET Scan – New Technology

- Positron Emission Tomography
- Requires an accelerator on site or nearby
- Uses 11C, 13N, 15O and 18F to label various metabolites (usually Glucose)
- Seeks active tissue (e.g. tumors)

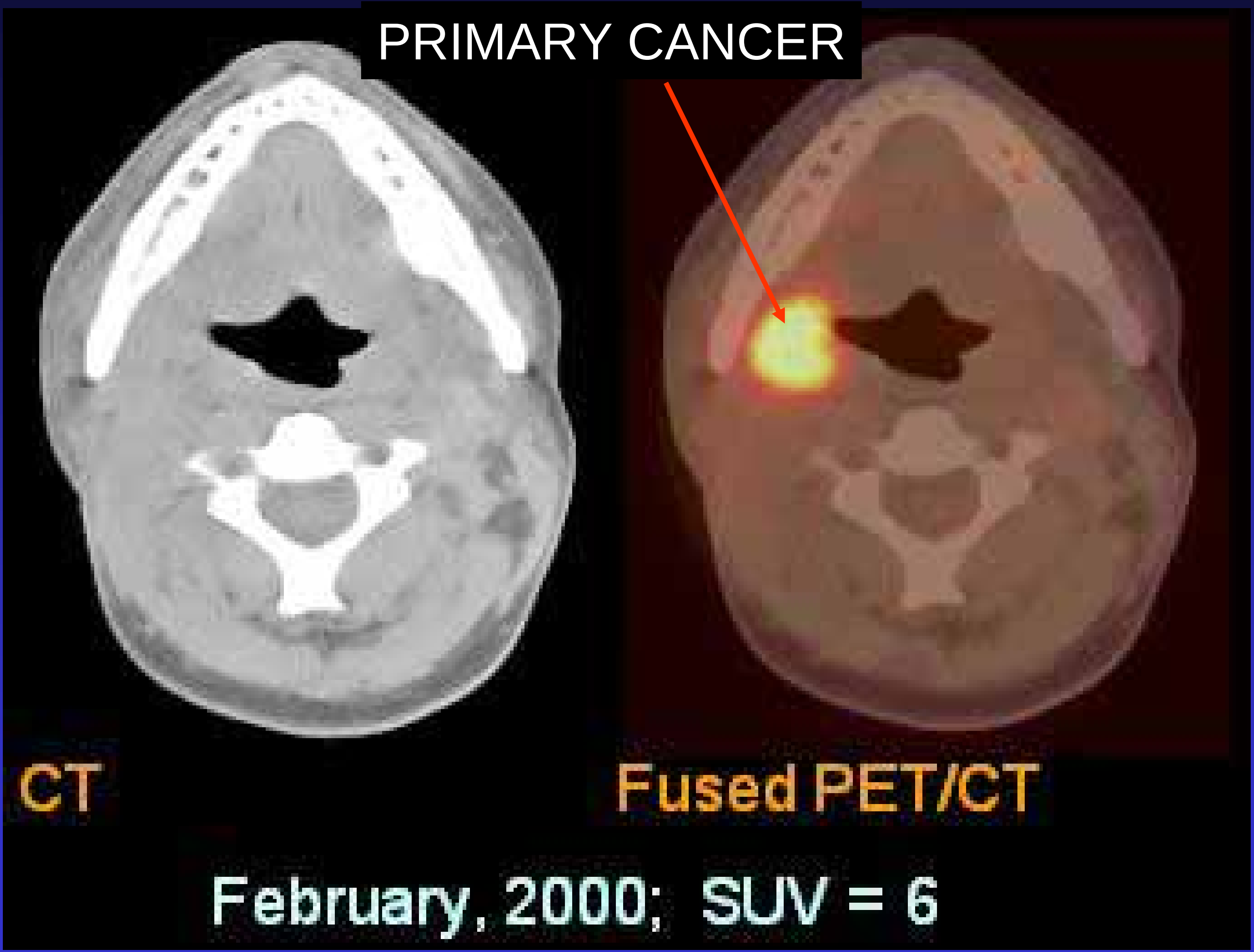




PET Accuracy

Cancer Type	Conventional Imaging	PET
Breast	67%	89%
Colorectal	80%	94%
Gastro-Esophageal	68%	83%
Head and Neck	65%	87%
Liver	81%	93%
Lung	68%	82%
Lymphoma	64%	88%
Melanoma	80%	91%
Pancreatic	65%	81%
Testicular	68%	92%
Uterine/Cervical	43%	87%

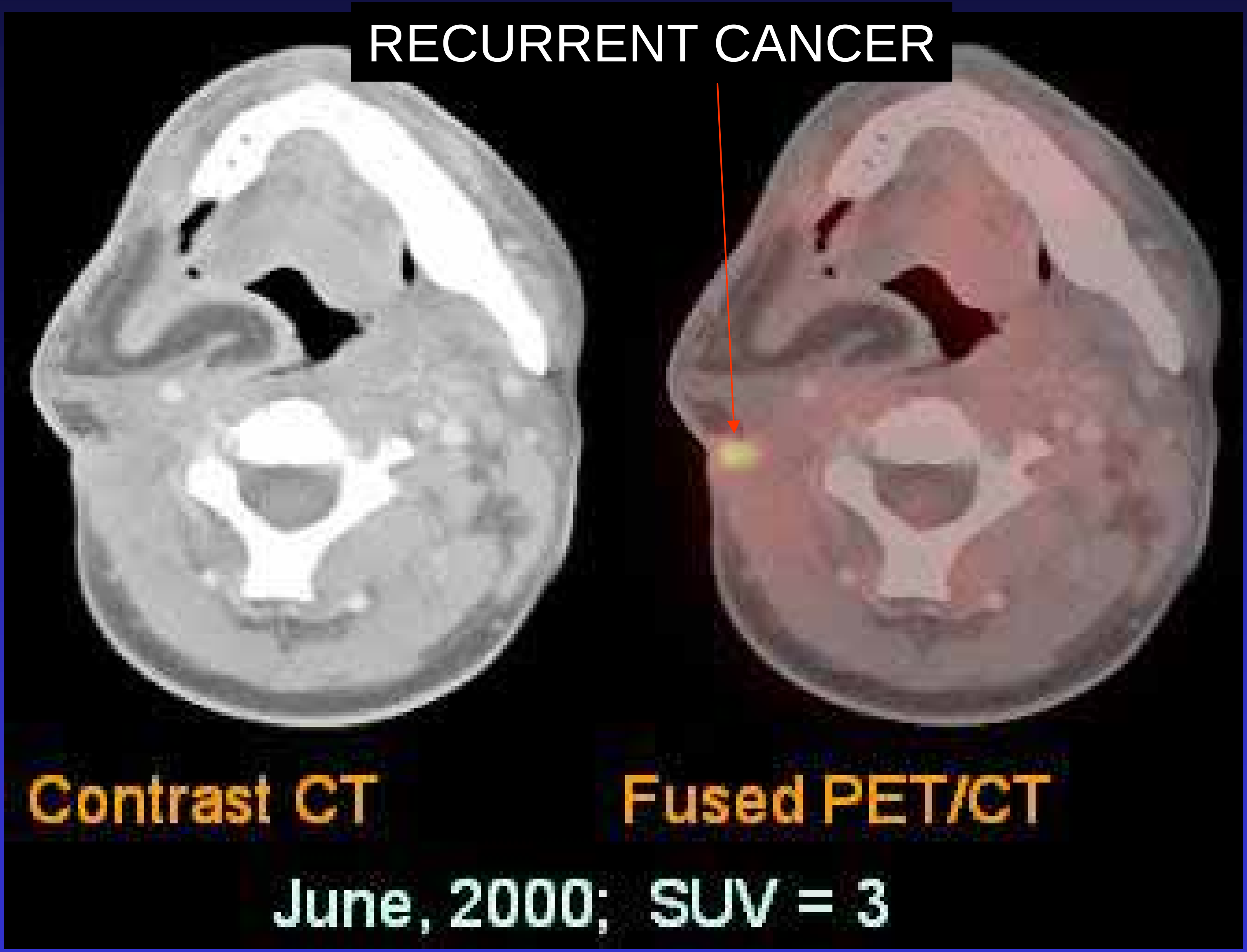
CT PET Scanning – Pre op



PRIMARY CANCER

February, 2000; SUV = 6

CT PET Scanning – Post op



IMAGING MODALITIES

- Radiographs (Xray)
  - Include barium swallow
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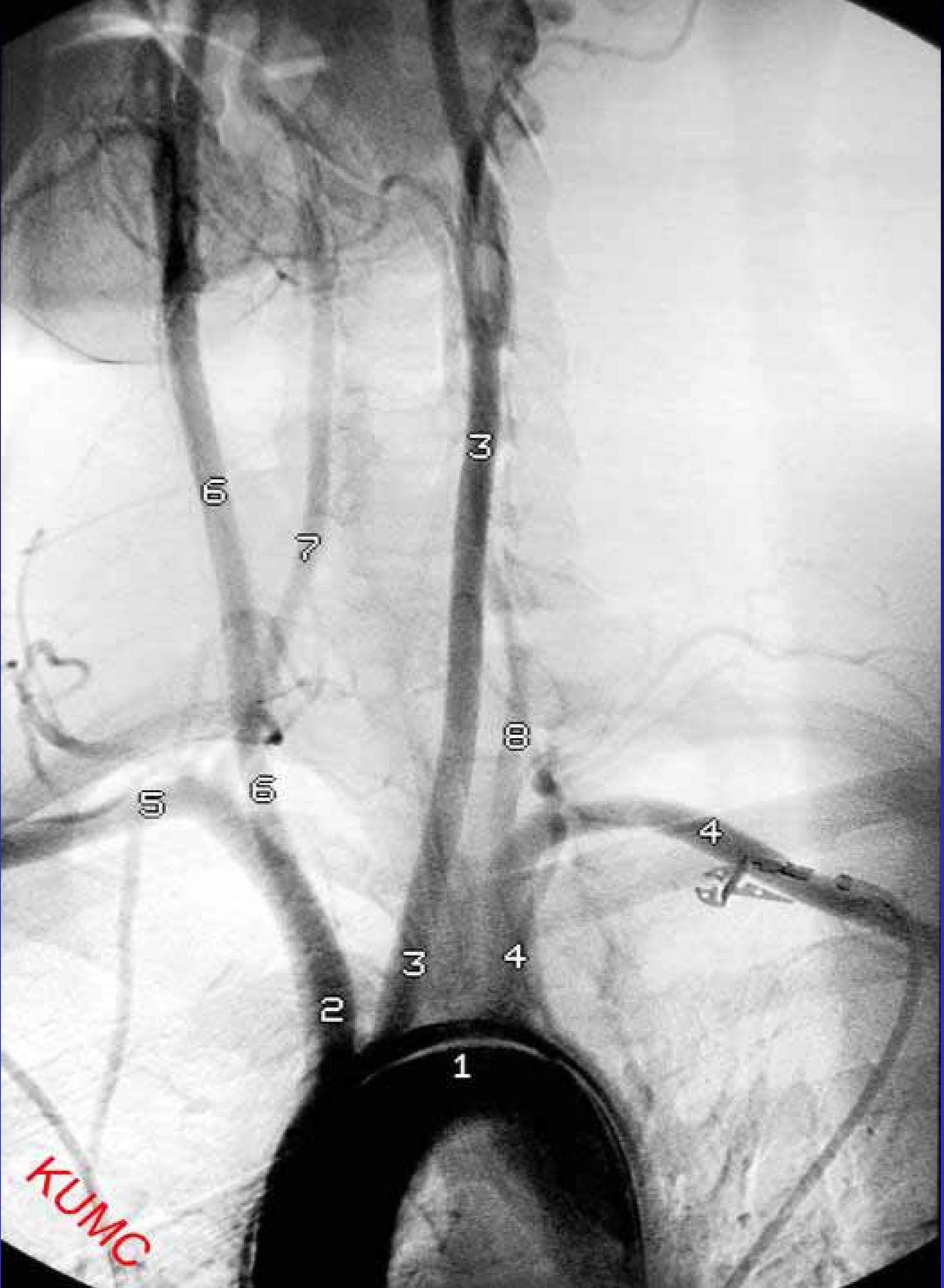
  - CT angiography
- Magnetic Resonance Imaging (MRI)
  - MR angiography

Carotid / Vertebral Angiography

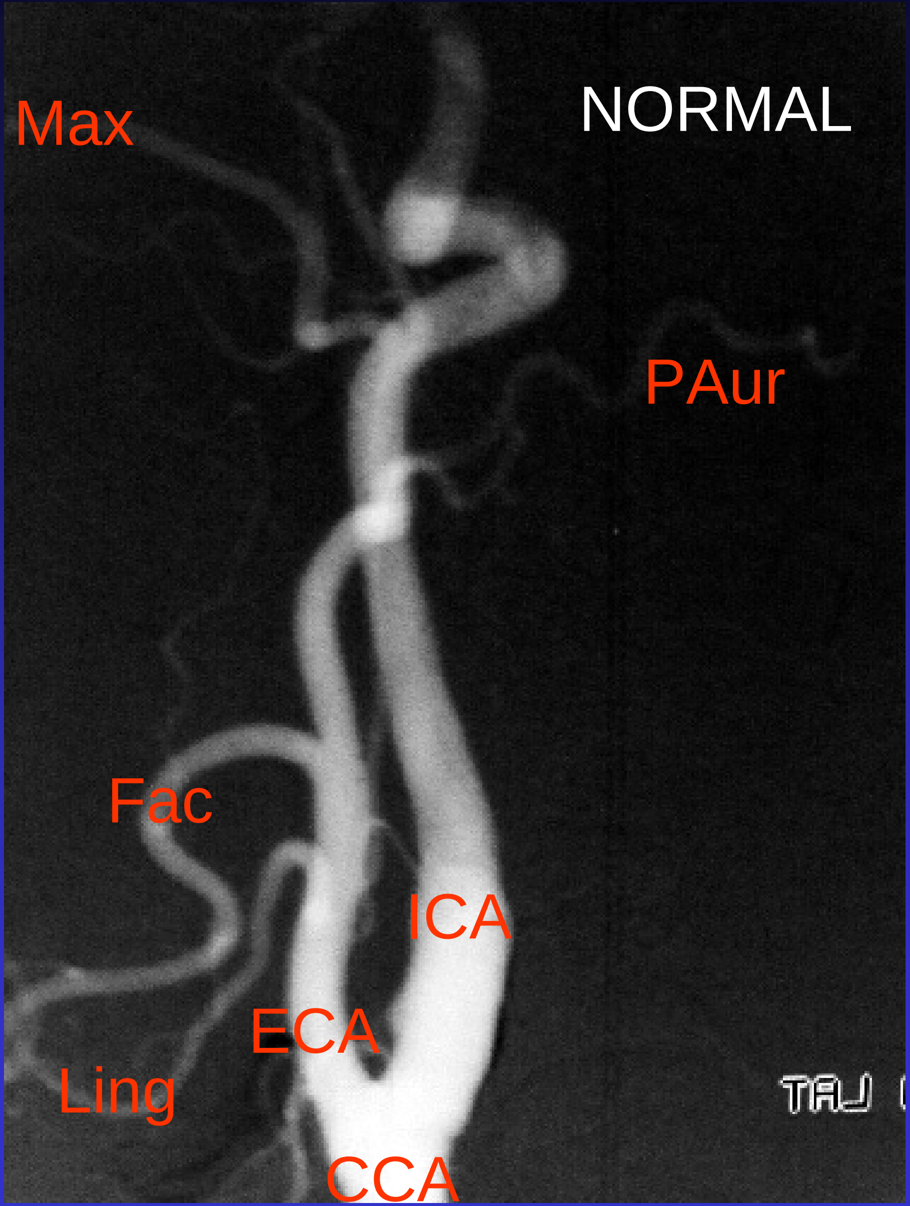
- Catheter in femoral artery
- Threaded up to aortic arch and into vessels
- Significant risk of stroke
- For diagnosis will be replaced by CT/MRI
- Still will use for interventional procedures
  - Carotid stents
  - Coils in aneurisms
  - Stopping hemorrhage (e.g. persistent nose bleeds)
  - Embolizing tumors
  - Treating vascular malformations

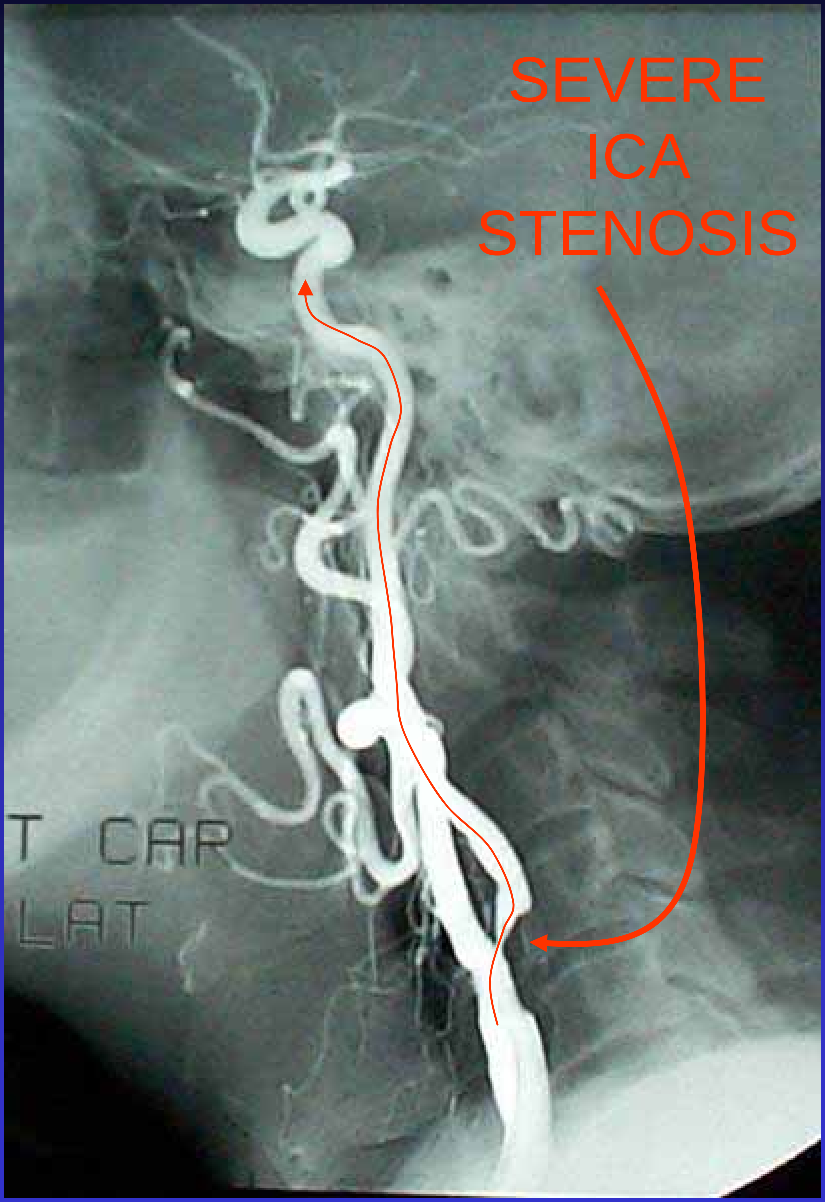
Arch Aortogram



1. Aortic arch
2. Brachiocephalic artery (innominate)
3. Left common carotid artery
4. Left subclavian artery
5. Right subclavian artery
6. Right common carotid artery
7. Right vertebral artery
8. Left vertebral artery

Carotid Bifurcation - Angiogram





External Carotid Artery Branches

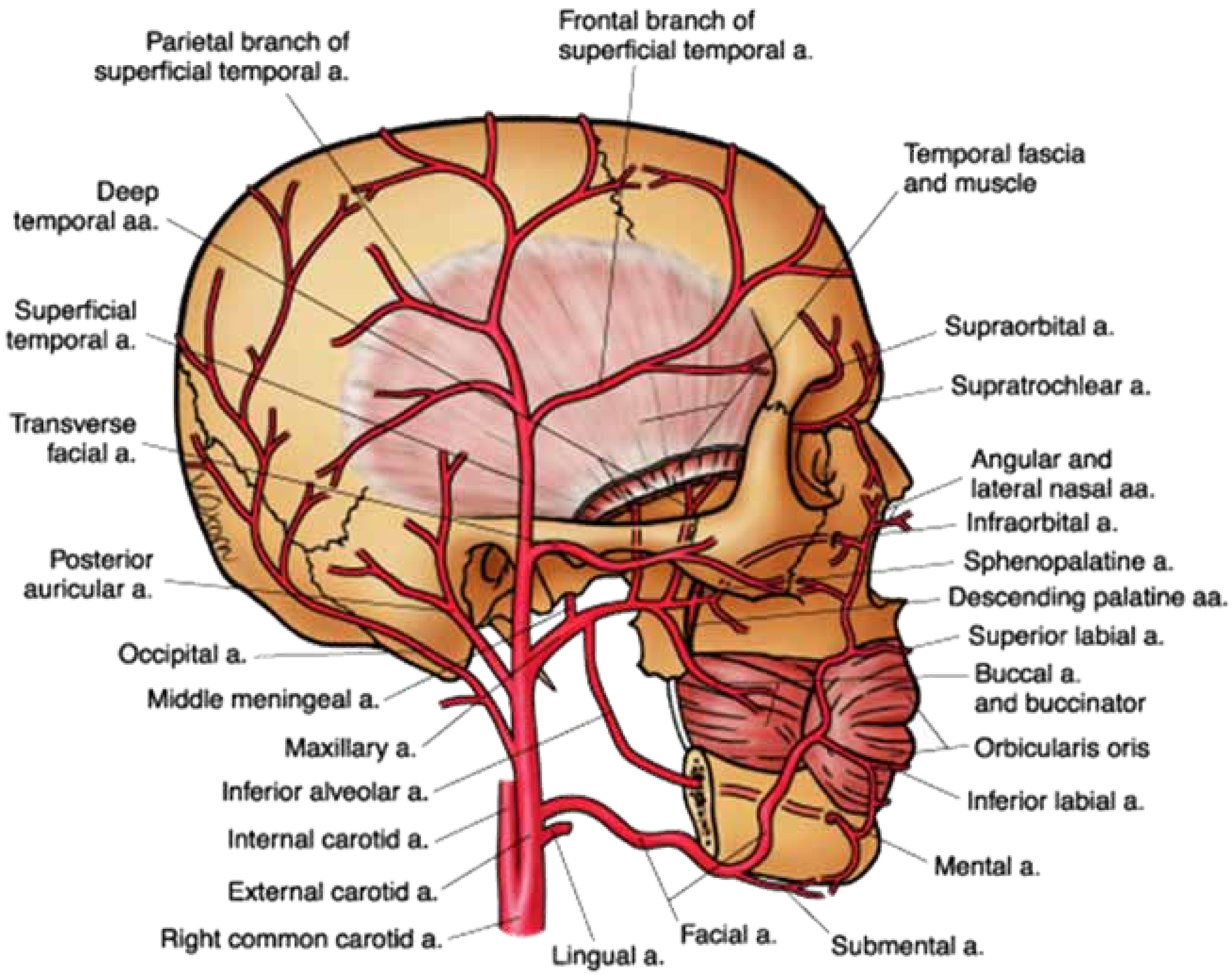


FIGURE 8.26 External carotid artery and its branches. Lateral view.

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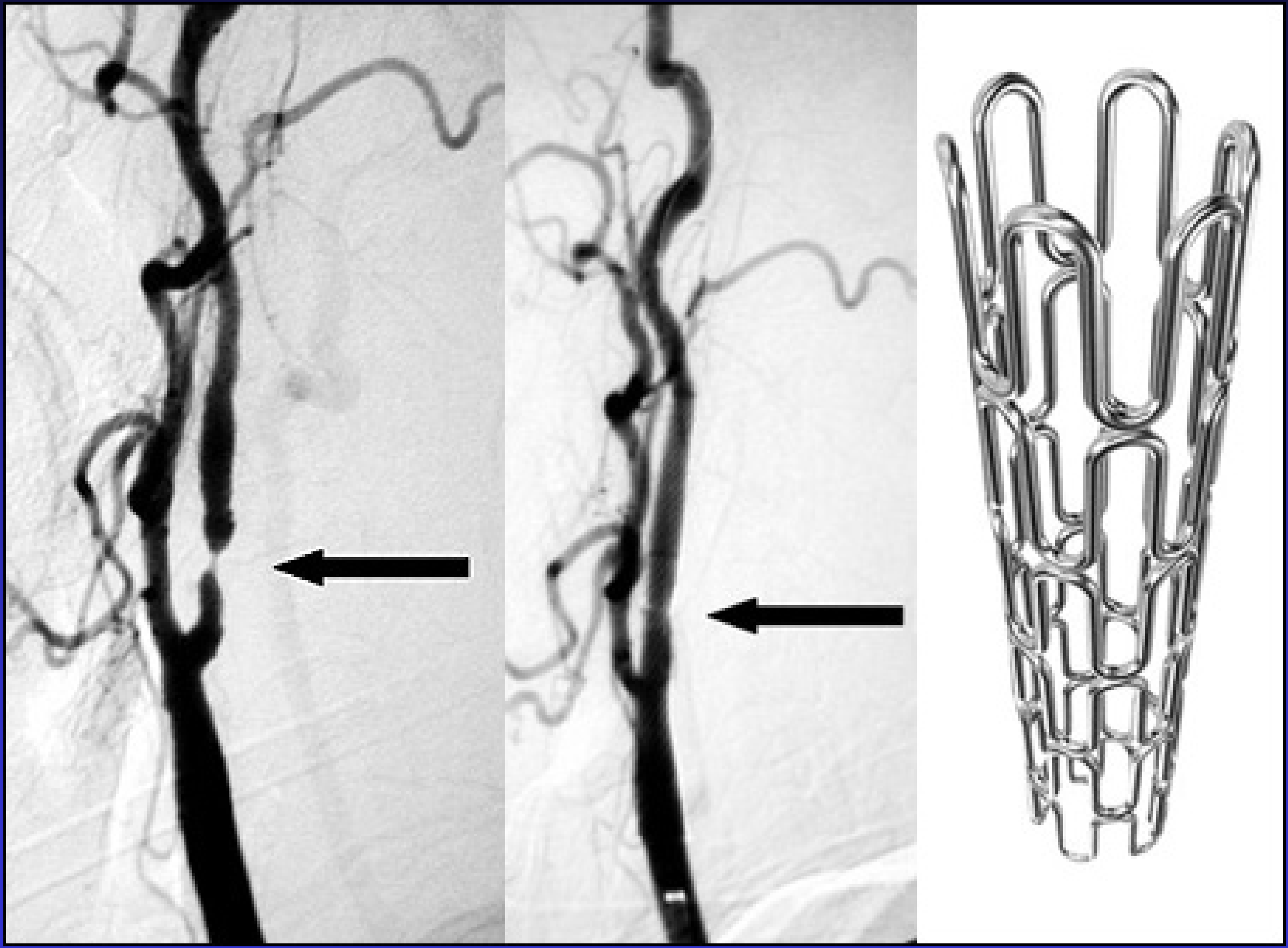
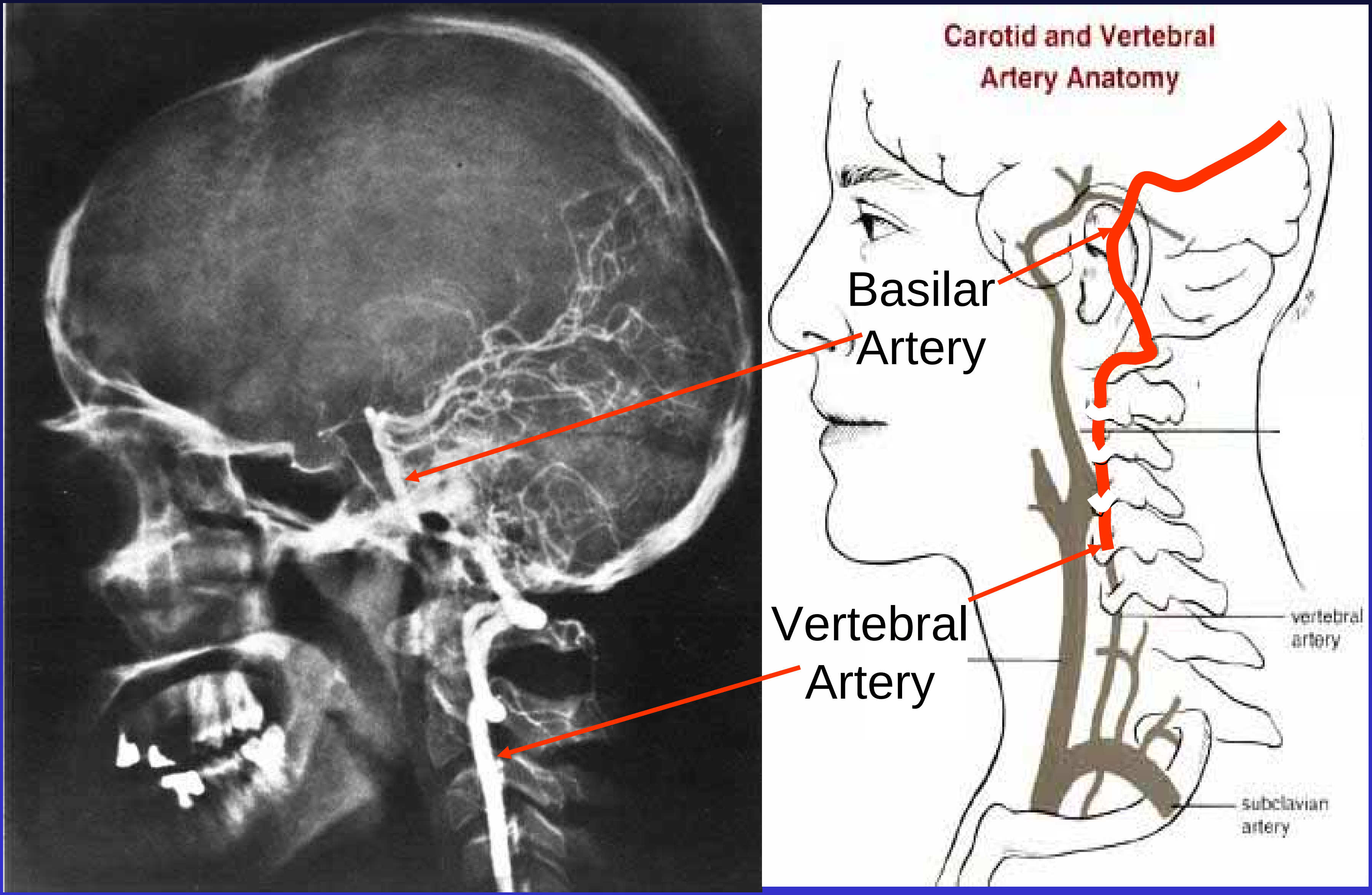
Some Anatomists Like Frosting, Others Prefer S & M

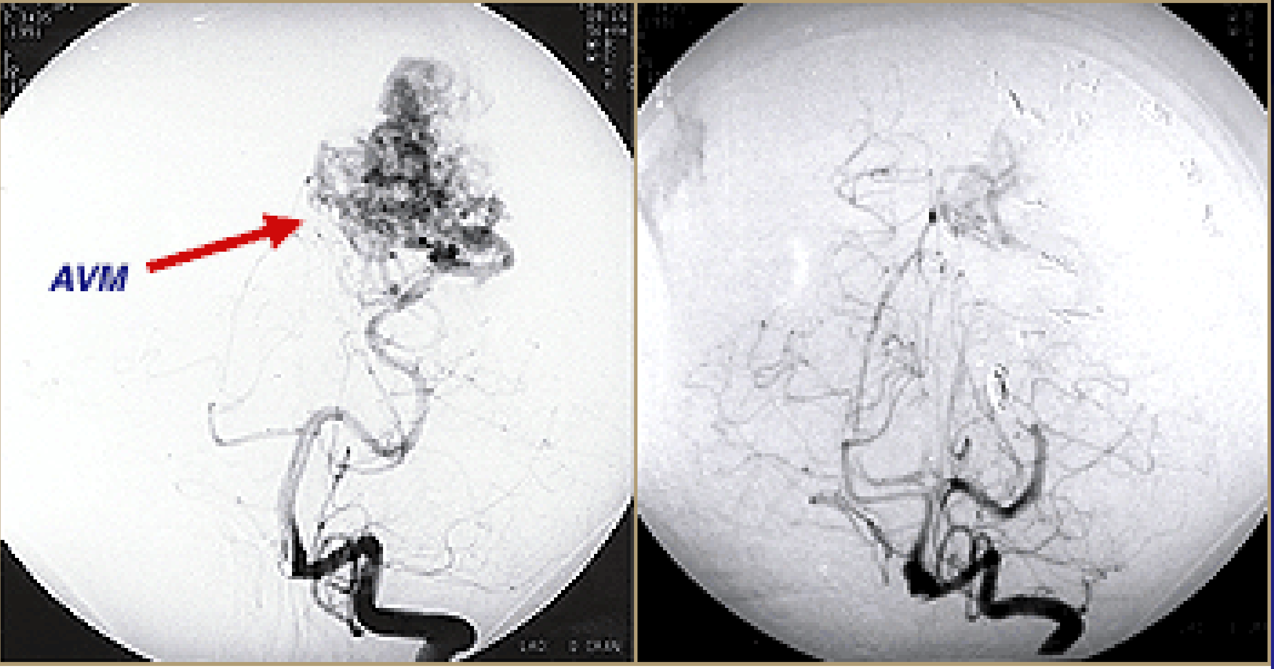
Carotid Stent Procedure



Vertebral Arteriogram

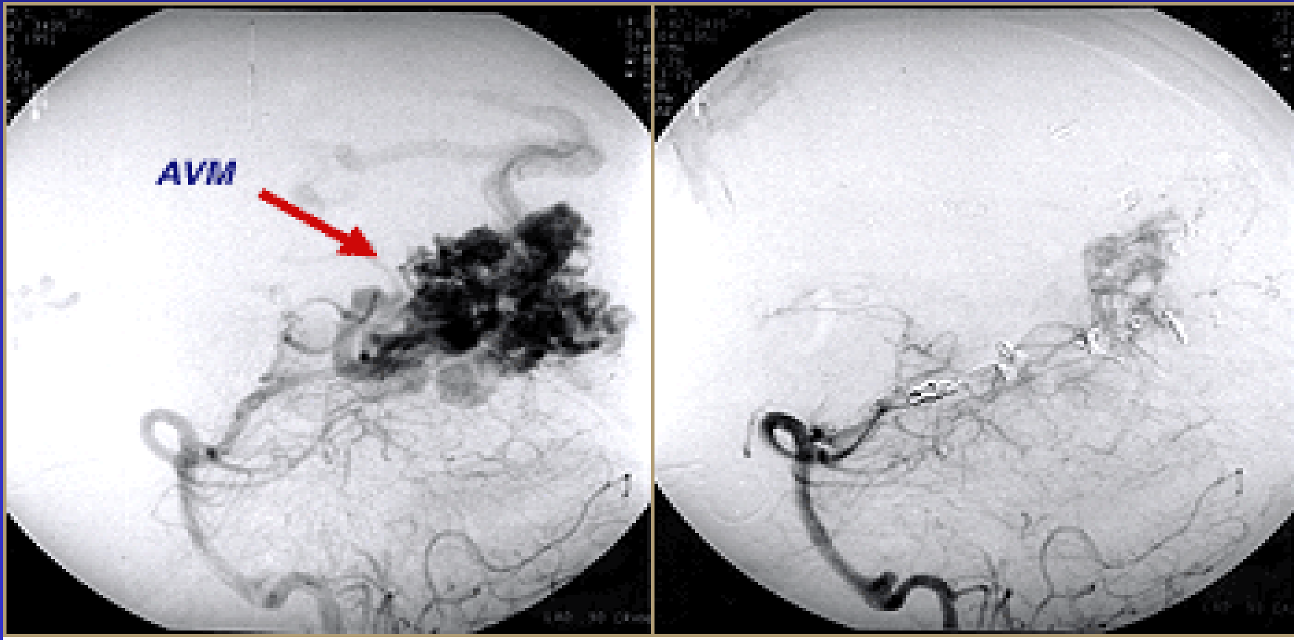


Trans catheter treatment of AVM X2



Occipital AVM before embolization (L) and after embolization (R).

THESE ARE
ALL VERTEBRAL
ARTERIOGAMS



Occipital AVM before embolization (L) and after embolization (R).

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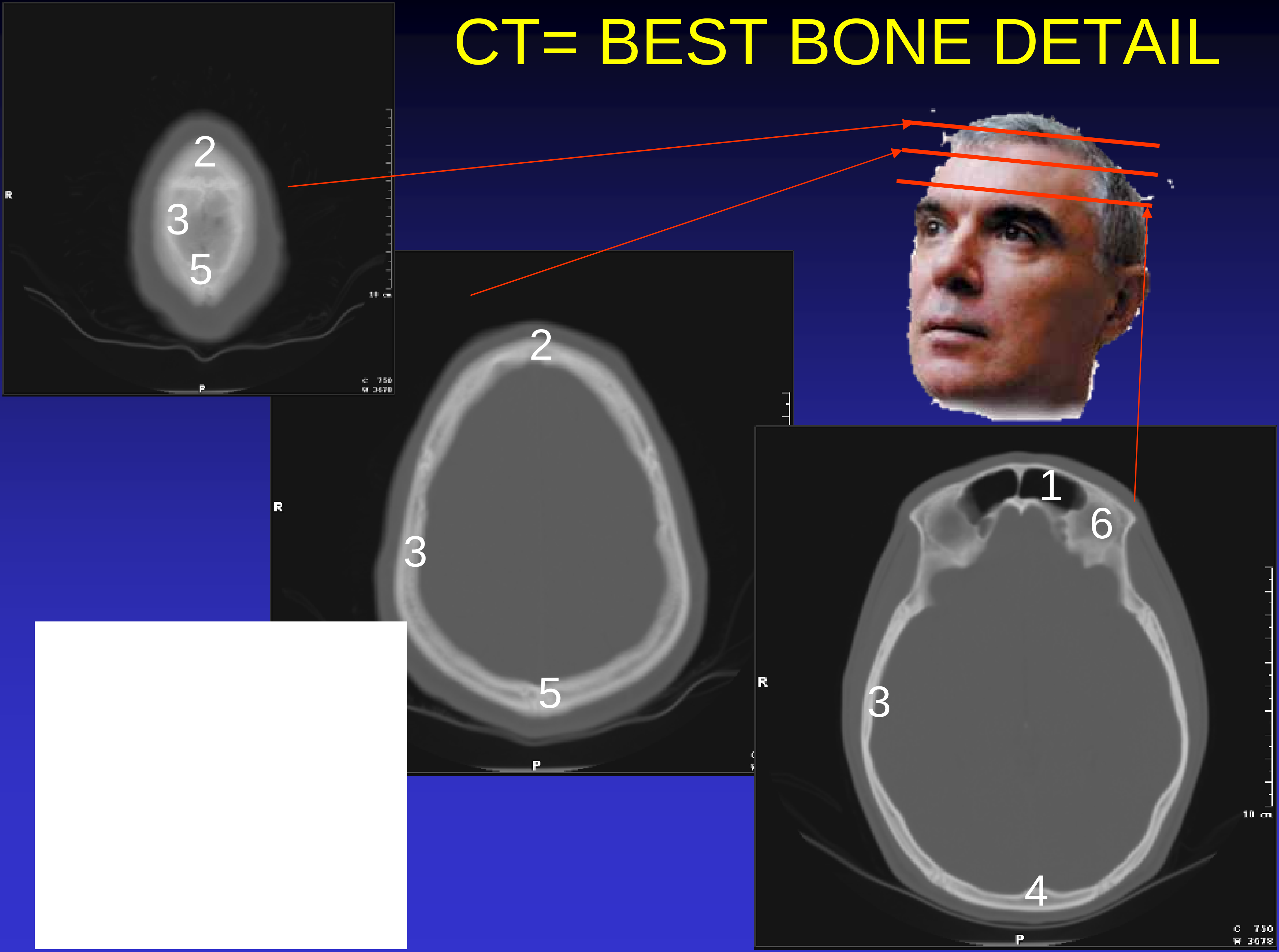
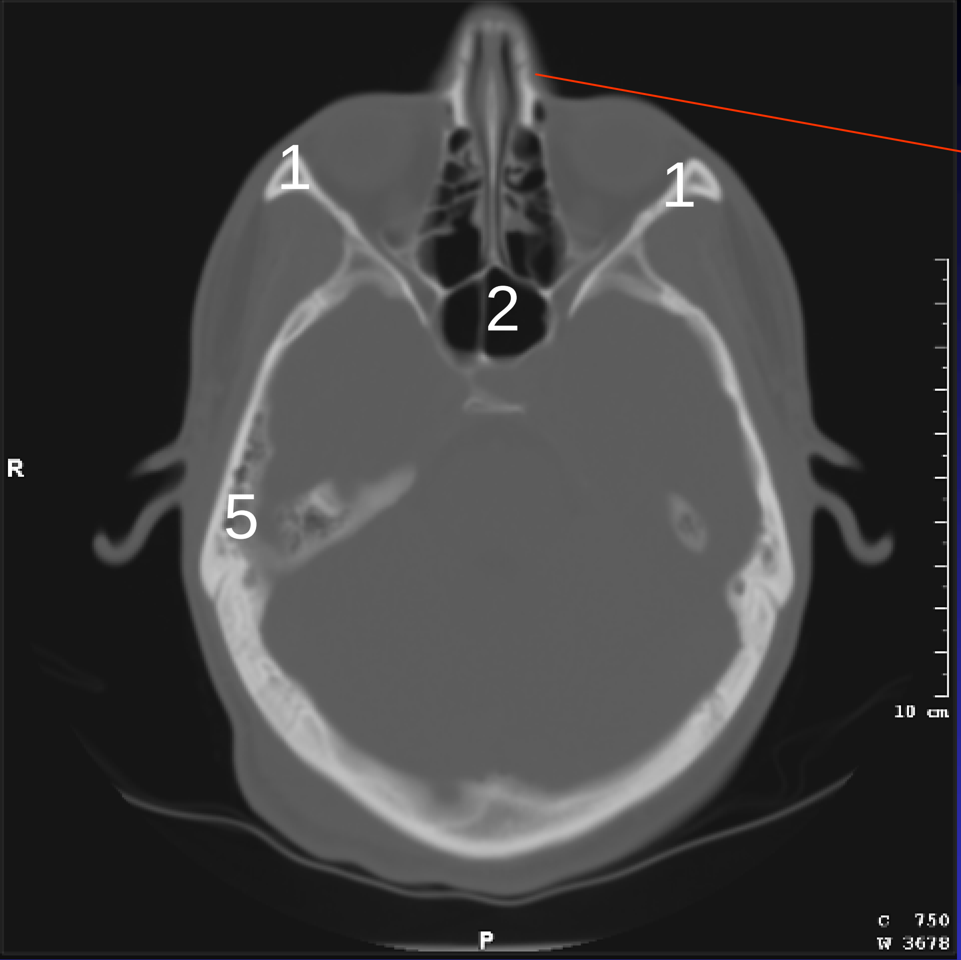
  - MR angiography

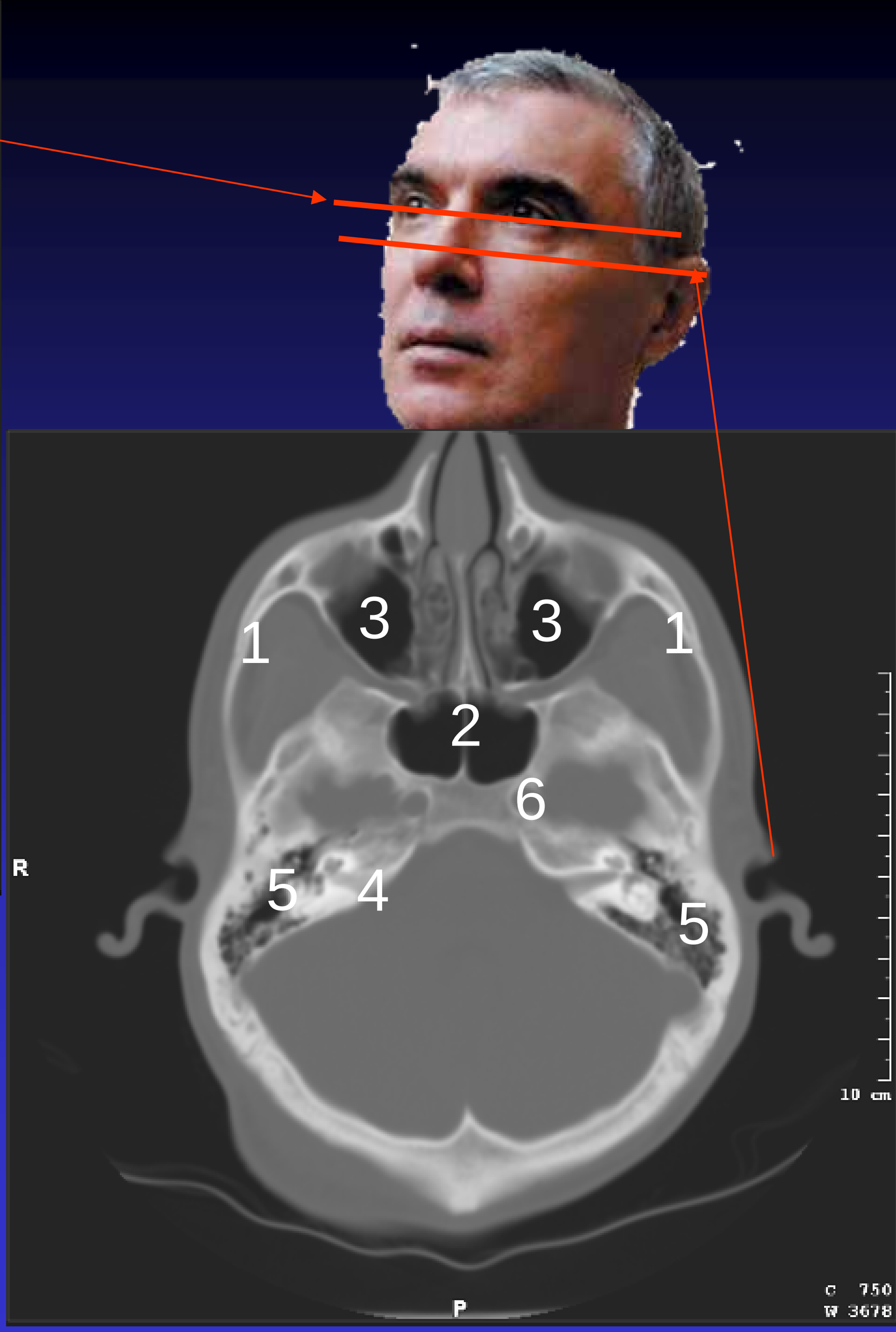
Head Face Neck CT

- So called “head CT” generally means to look at the brain and extra axial spaces
  - e.g. Stroke, trauma, after neurosurgery
  - Often OK to perform without Iodine contrast
  - Often MRI substitutes for CT and is superior
- Otherwise, there are many CT protocols that are used depending on reasons for exam
  - e.g. Orbits, Temporal Bone, Sinuses, head & neck cancer, facial trauma, and so on
  - Many of these are done with Iodine contrast
  - Often MRI does NOT substitute and CT is best

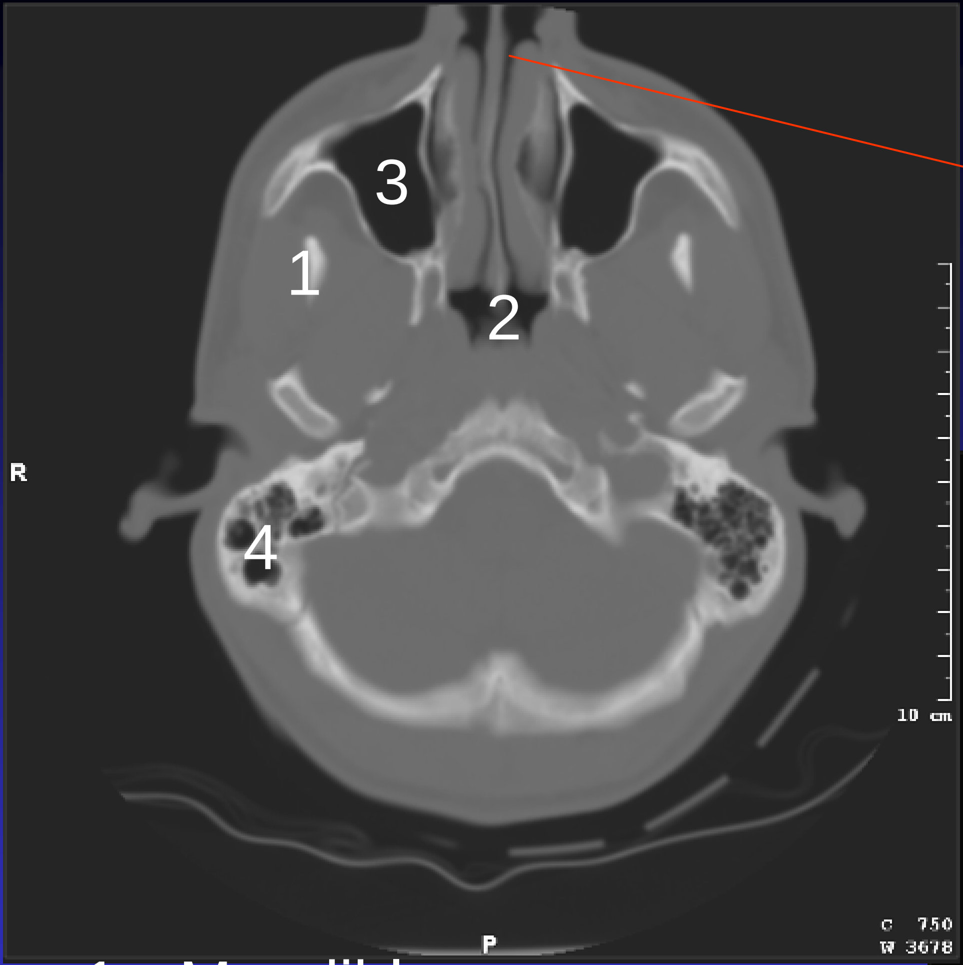
CT= BEST BONE DETAIL

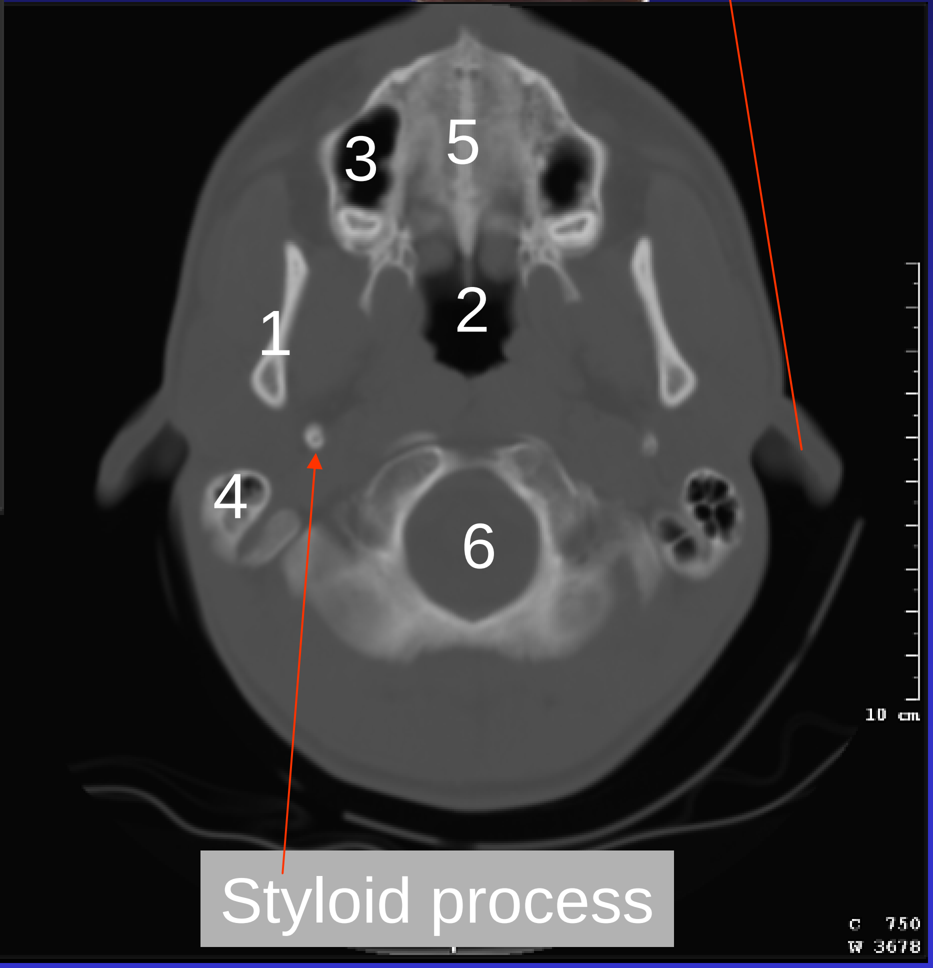






1. Zygoma
2. Sphenoid sinus
3. Maxillary sinus
4. Internal auditory canal
5. Mastoid air cells
6. Internal carotid canal



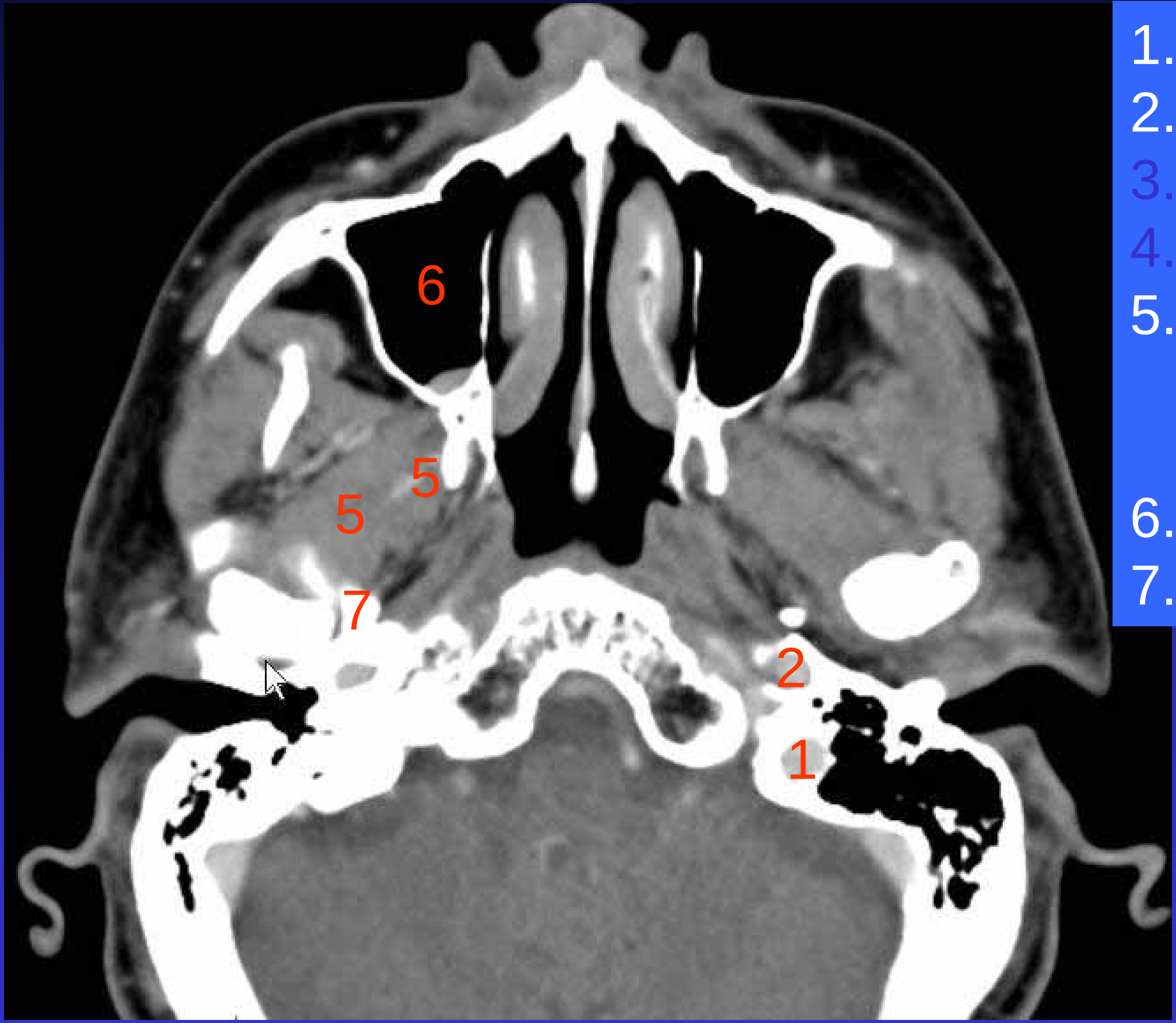


1. Mandible
2. Nasopharynx
3. Maxillary sinus
4. Mastoid process
5. Hard palette
6. Foramen magnum

CT For Soft Tissue Detail

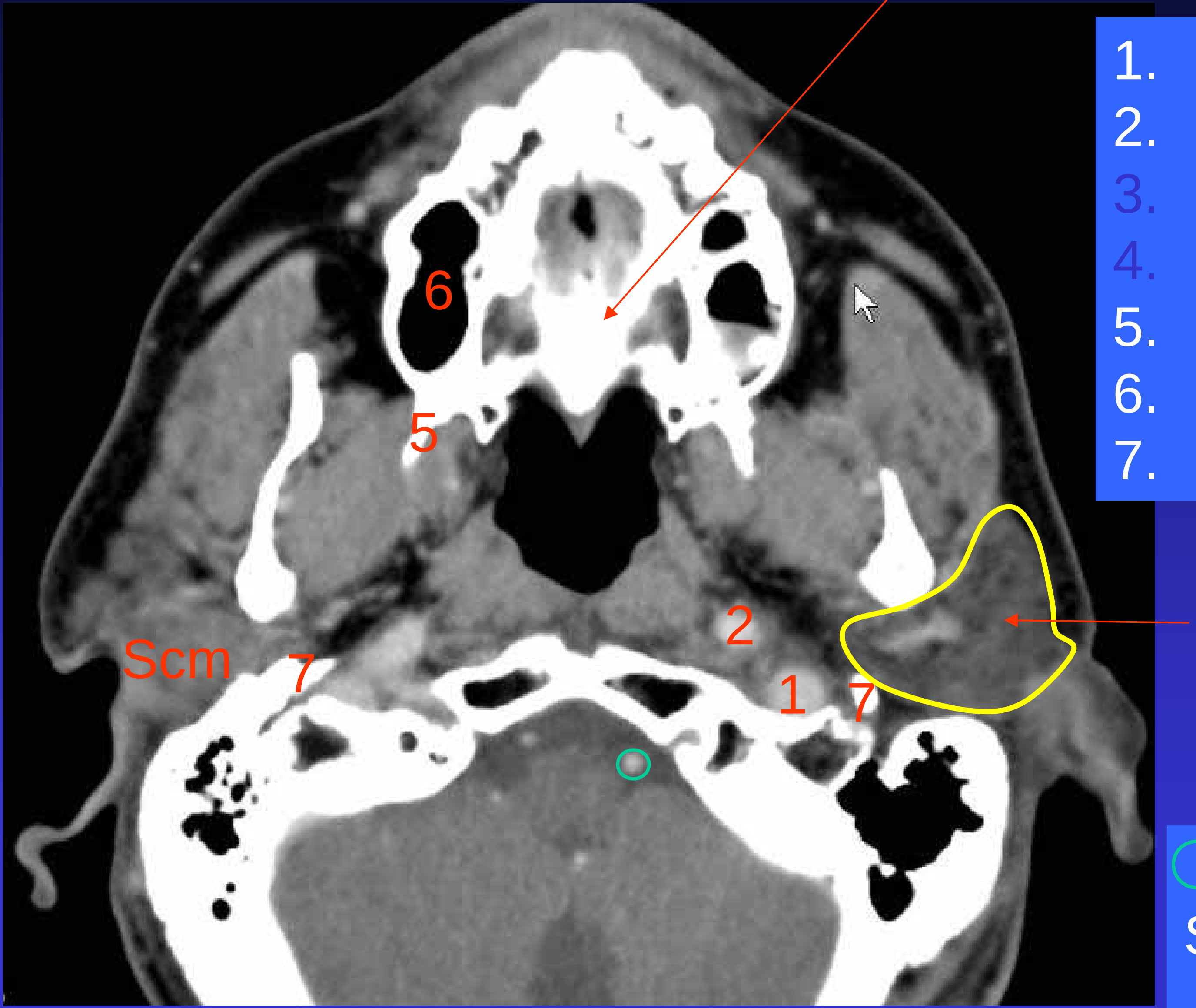
- CT is generally the best choice for most
- Big difference between scans done without and with Iodine contrast
- Without contrast almost no differentiation between various soft tissues (all grey)
- With contrast, of course, vessels are visible
- With contrast, other tissues enhance more or less and this allows us to distinguish the margins of structures much better
    - Muscles, lymph nodes, etc

CT Above Hard Palette



1. IJ vein
2. Int carotid
3. Ext carotid
4. Common carotid
5. Lat Ptergoid mm attaching to Ptergoid plate
6. Maxillary sinus
7. Styloid process

CT At Hard Palette

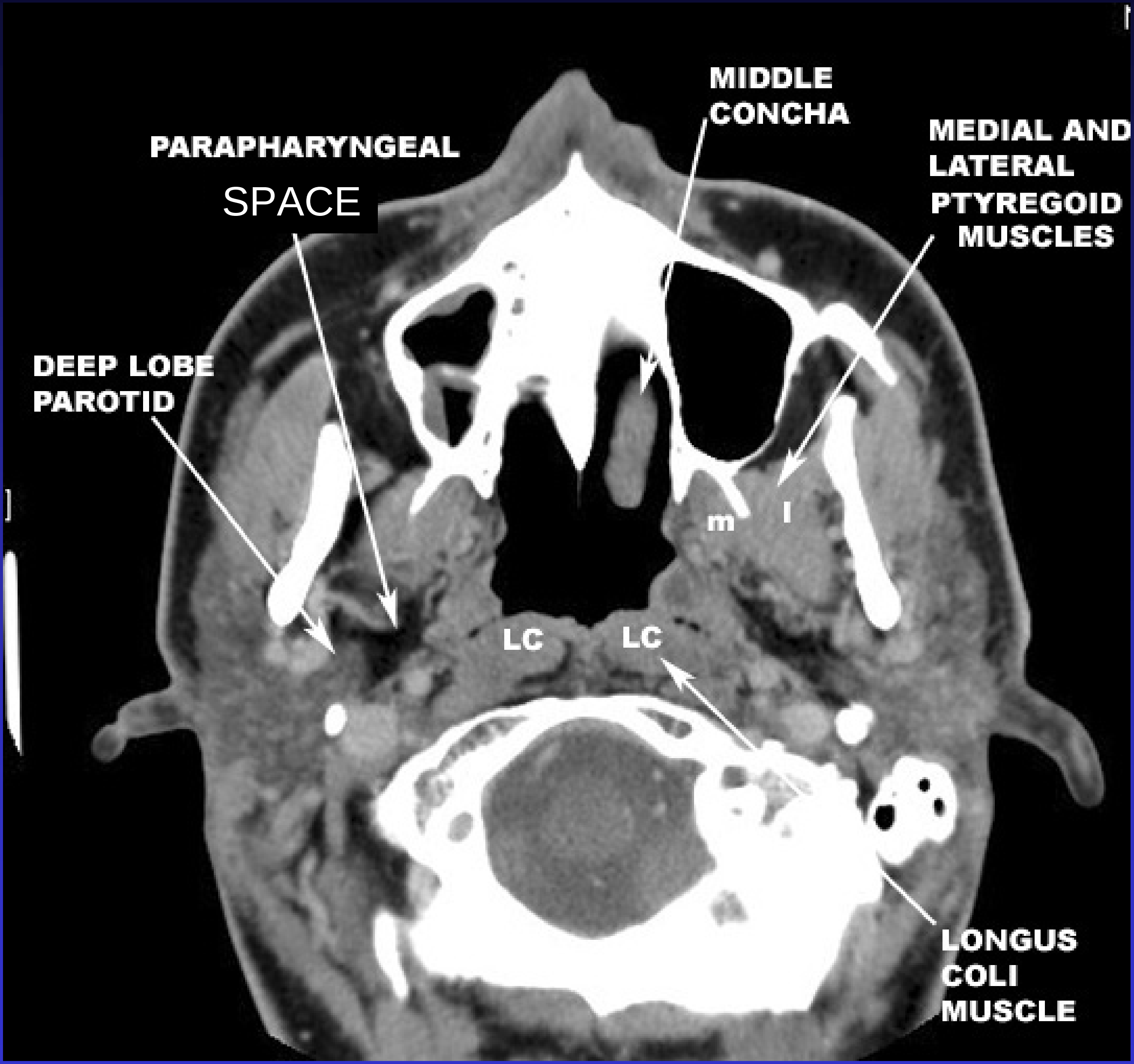


1. IJ vein
2. Int carotid
3. Ext carotid
4. Common carotid
5. Ptergoid plate
6. Maxillary sinus
7. Styloid process

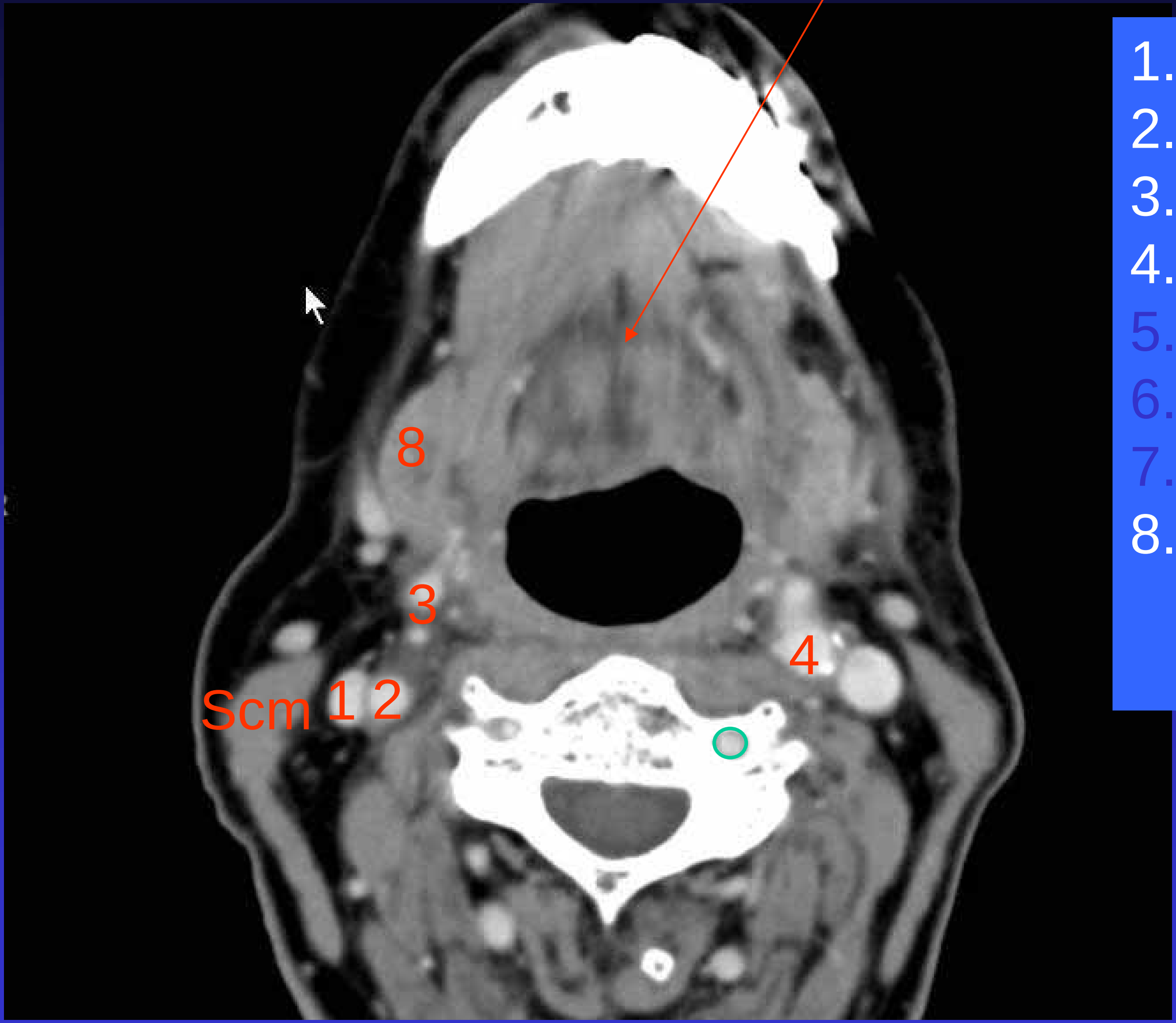
Parotid gland

○=L vert art
Scm=Sternocleido mastoid

CT At Hard Palette



CT At Floor Of Mouth

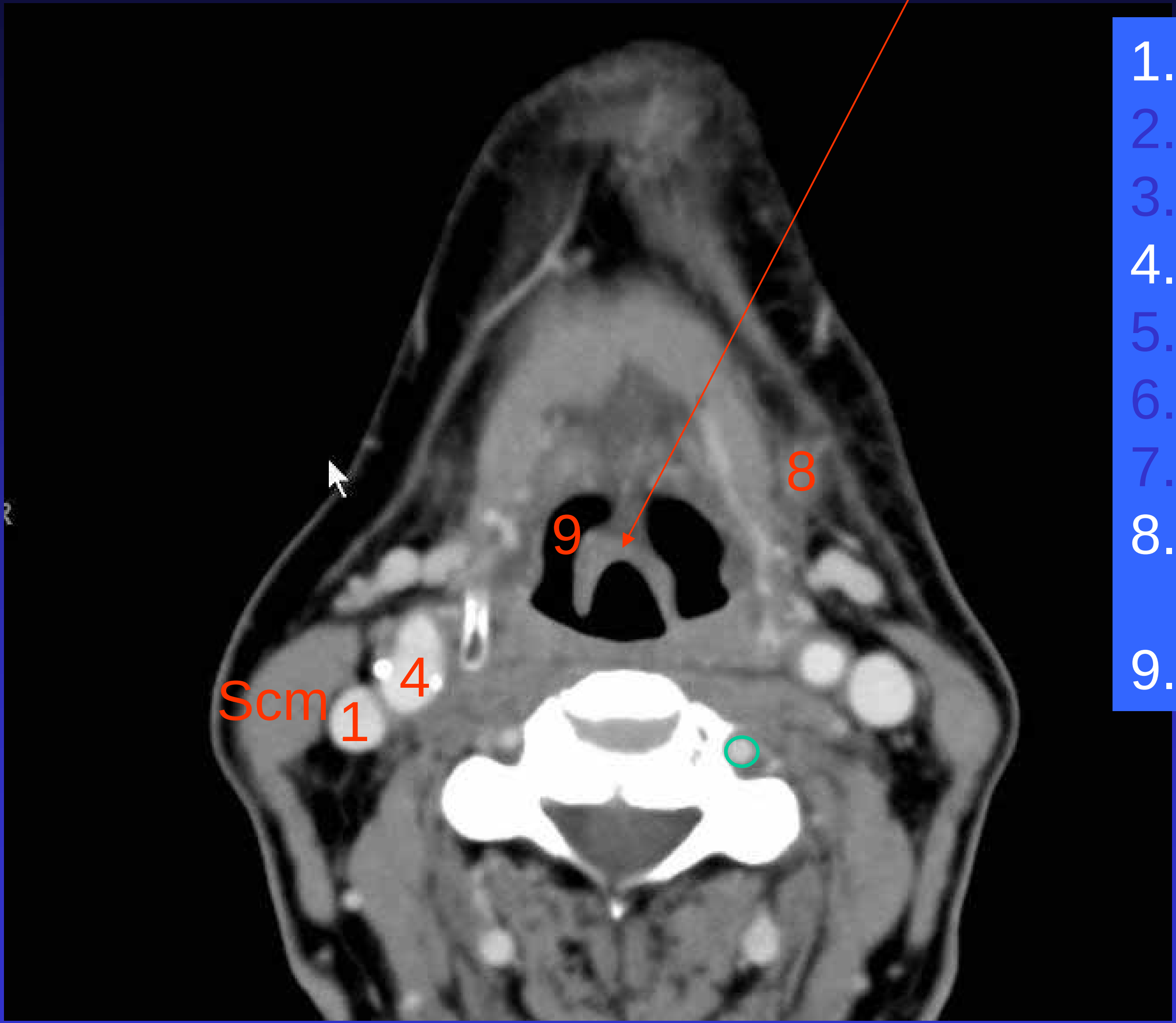


1. IJ vein
2. Int carotid
3. Ext carotid
4. Common carotid
5. Ptergoid plate
6. Maxillary sinus
7. Styloid process
8. Submandibular gland

○ =L vert art

Scm=Sternocleido mastoid

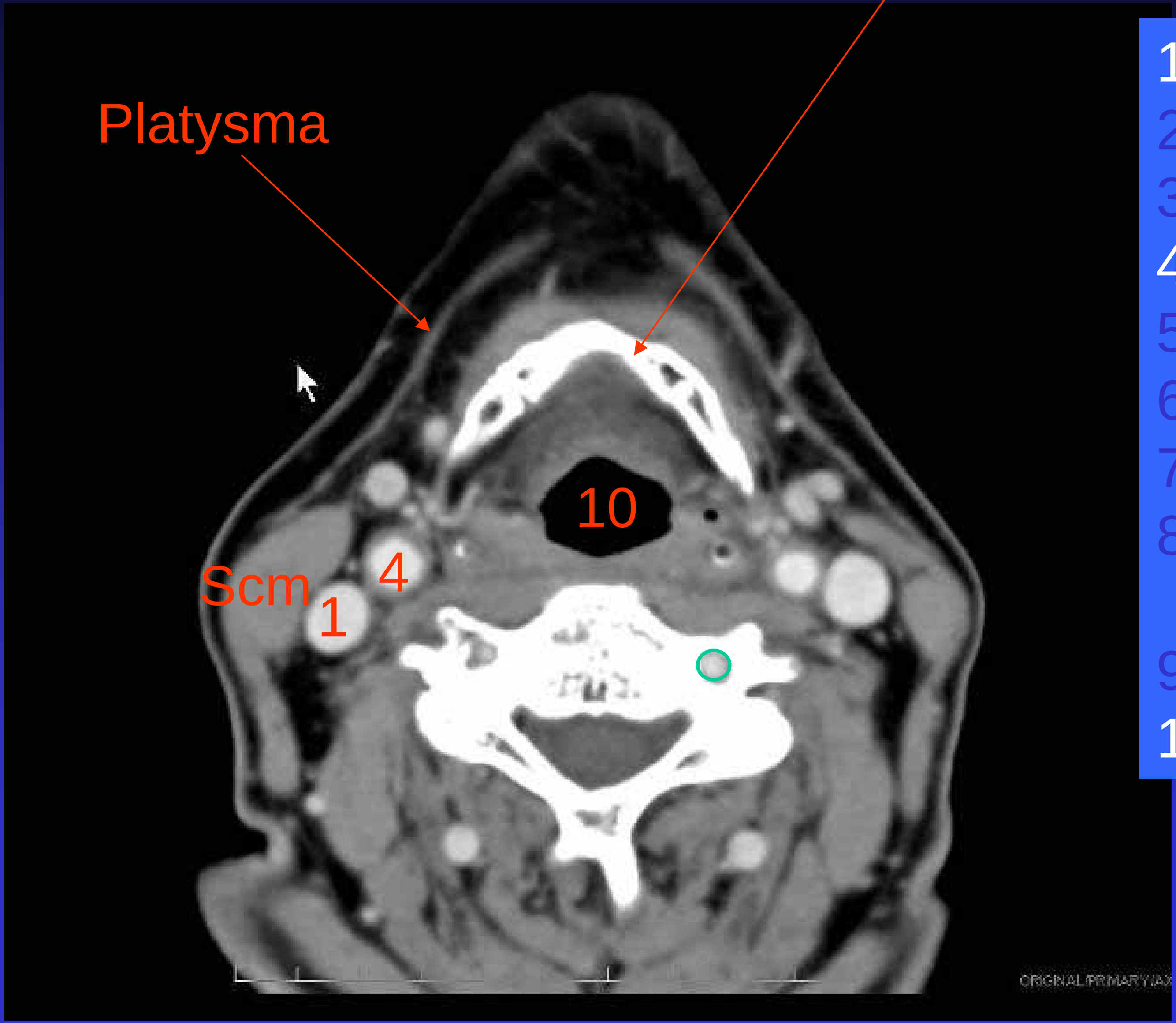
CT At Epiglottis



1. IJ vein
2. Int carotid
3. Ext carotid
4. Common carotid
5. Ptergoid plate
6. Maxillary sinus
7. Styloid process
8. Submandibular gland
9. Valecula

○=L vert art
Scm=Sternocleido mastoid

CT At Hyoid Bone

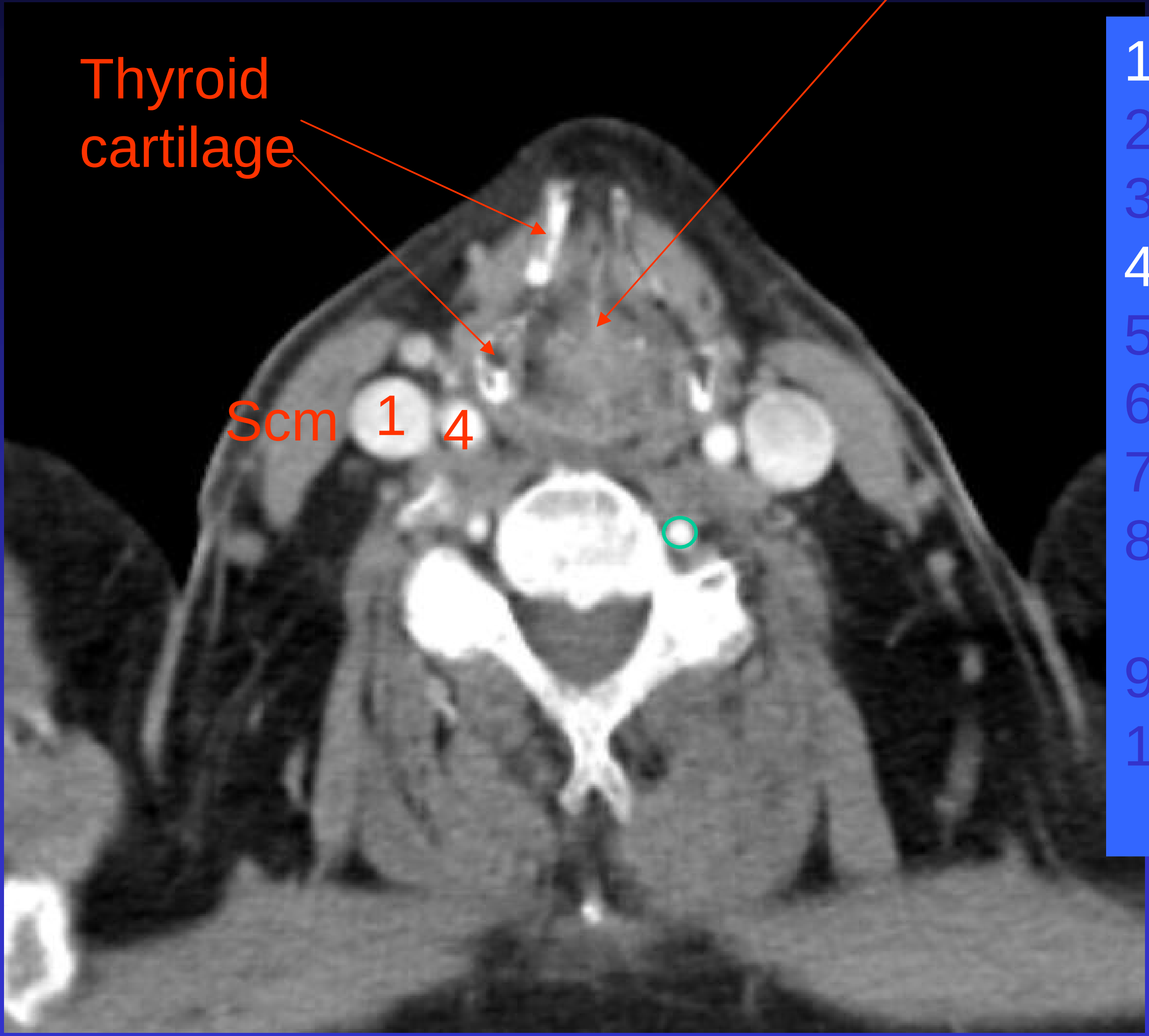


1. IJ vein
2. Int carotid
3. Ext carotid
4. Common carotid
5. Ptergoid plate
6. Maxillary sinus
7. Styloid process
8. Submandibular gland
9. Valecula
10. Larynx

○ =L vert art

Scm=Sternocleido mastoid

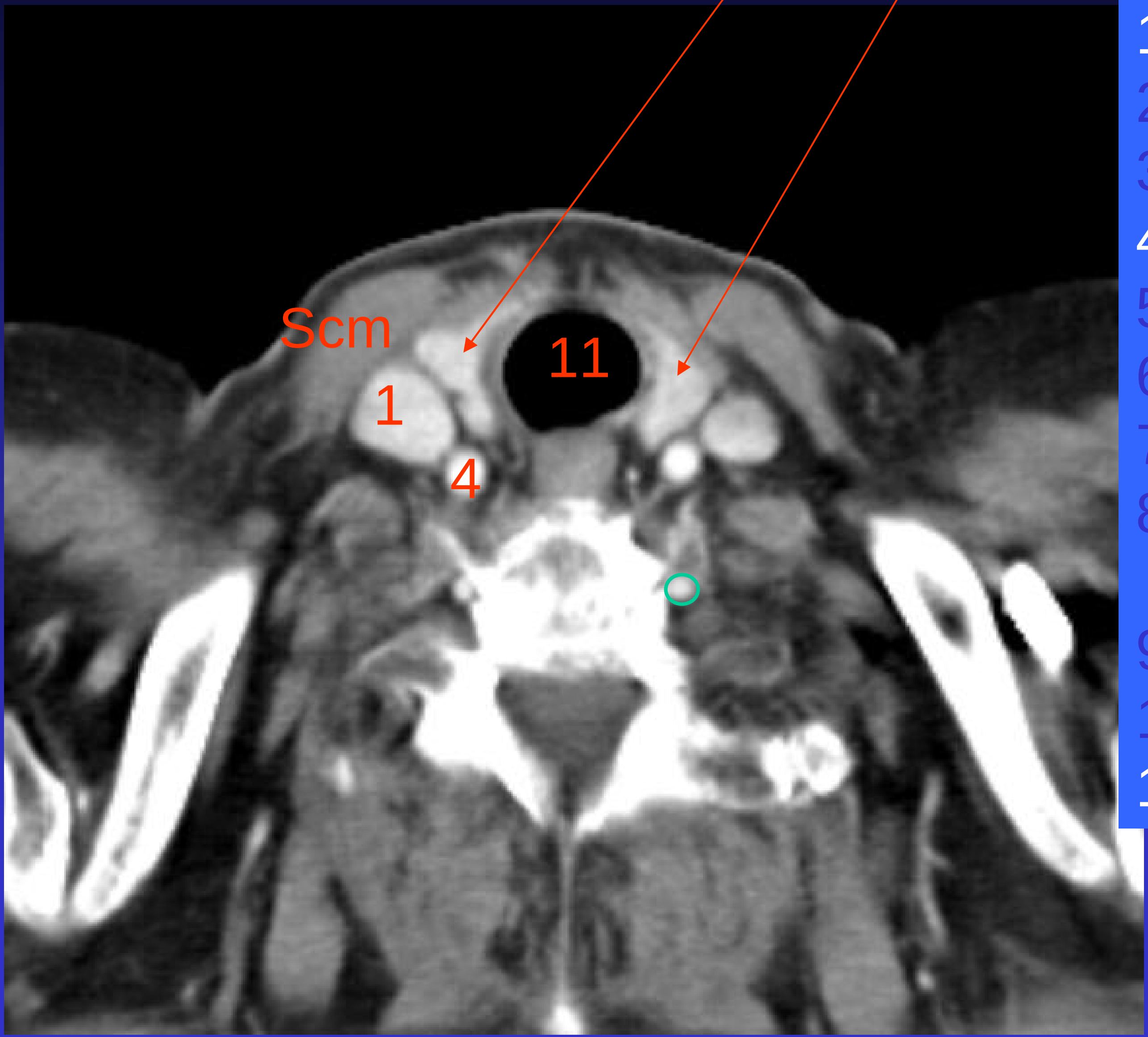
CT At Vocal Cords



1. IJ vein
2. Int carotid
3. Ext carotid
4. Common carotid
5. Ptergoid plate
6. Maxillary sinus
7. Styloid process
8. Submandibular gland
9. Valecula
10. Larynx

○ =L vert art
Scm=Sternocleido mastoid

CT At Thyroid Gland

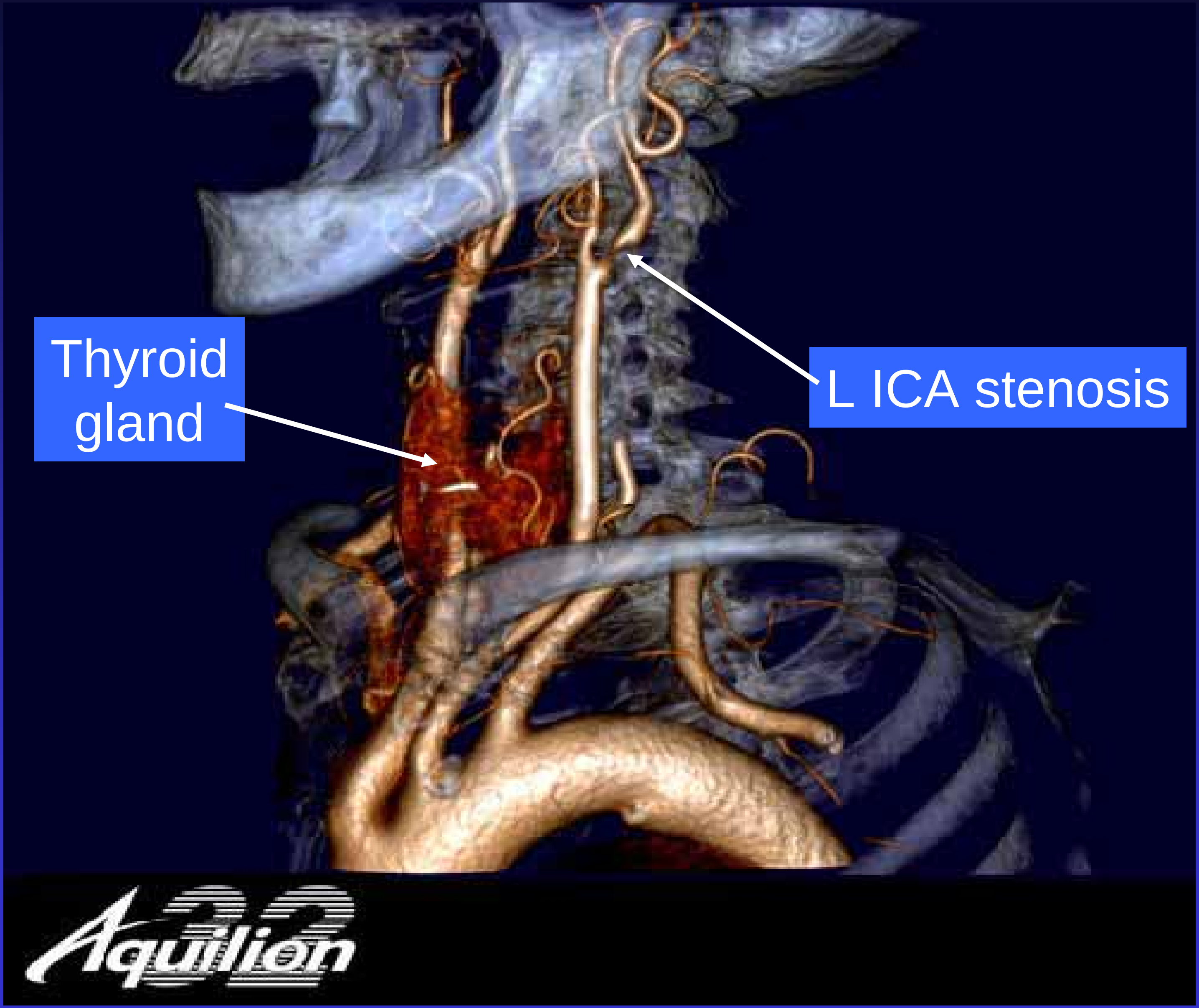


1. IJ vein
2. Int carotid
3. Ext carotid
4. Common carotid
5. Ptergoid plate
6. Maxillary sinus
7. Styloid process
8. Submandibular gland
9. Valecula
10. Larynx
11. Trachea

○ =L vert art

Scm=Sternocleido mastoid

CT Angiogram (CTA)

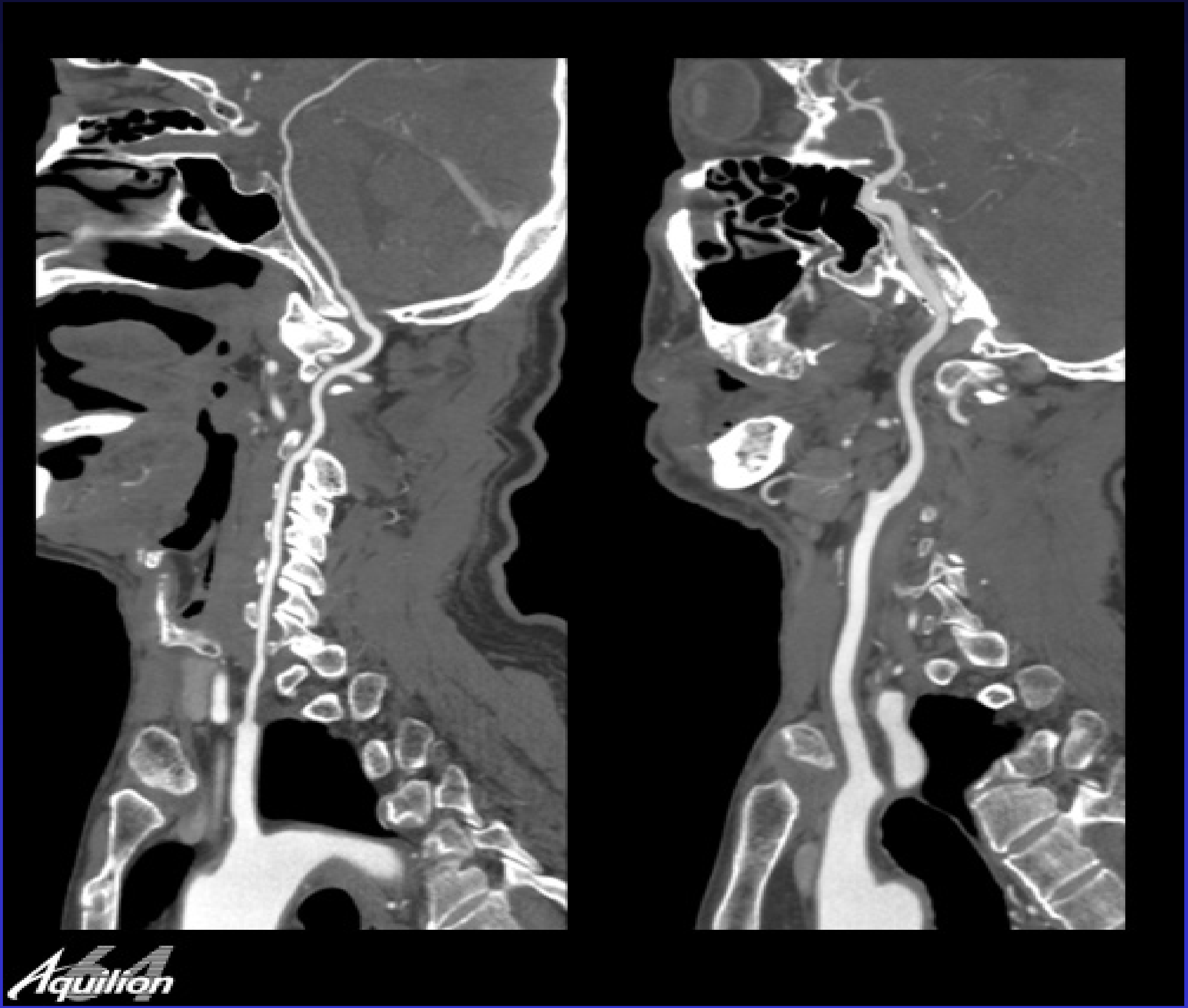


Thyroid gland

L ICA stenosis

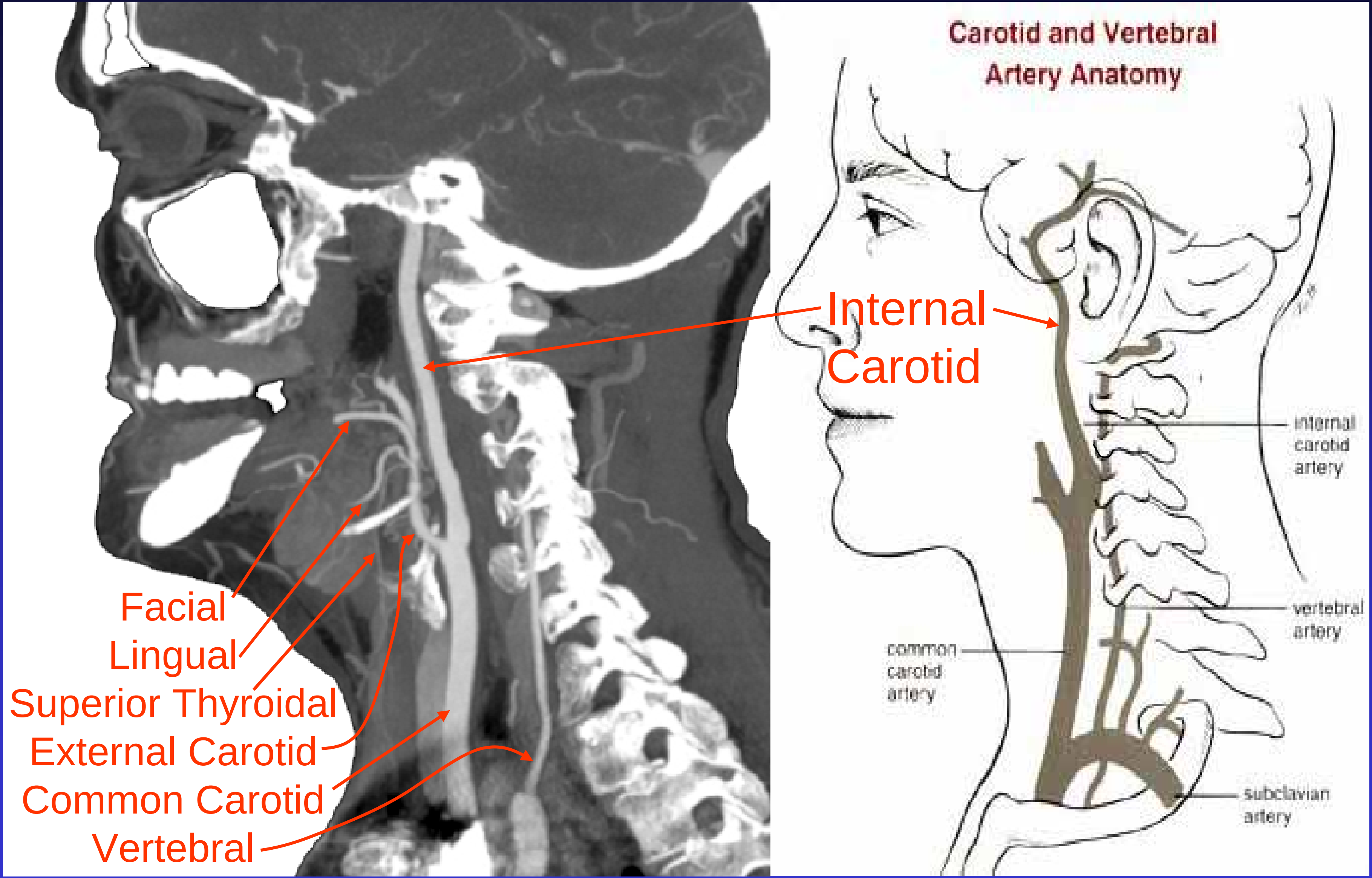
CT Angiogram (CTA)

VERTEBRAL



CAROTID

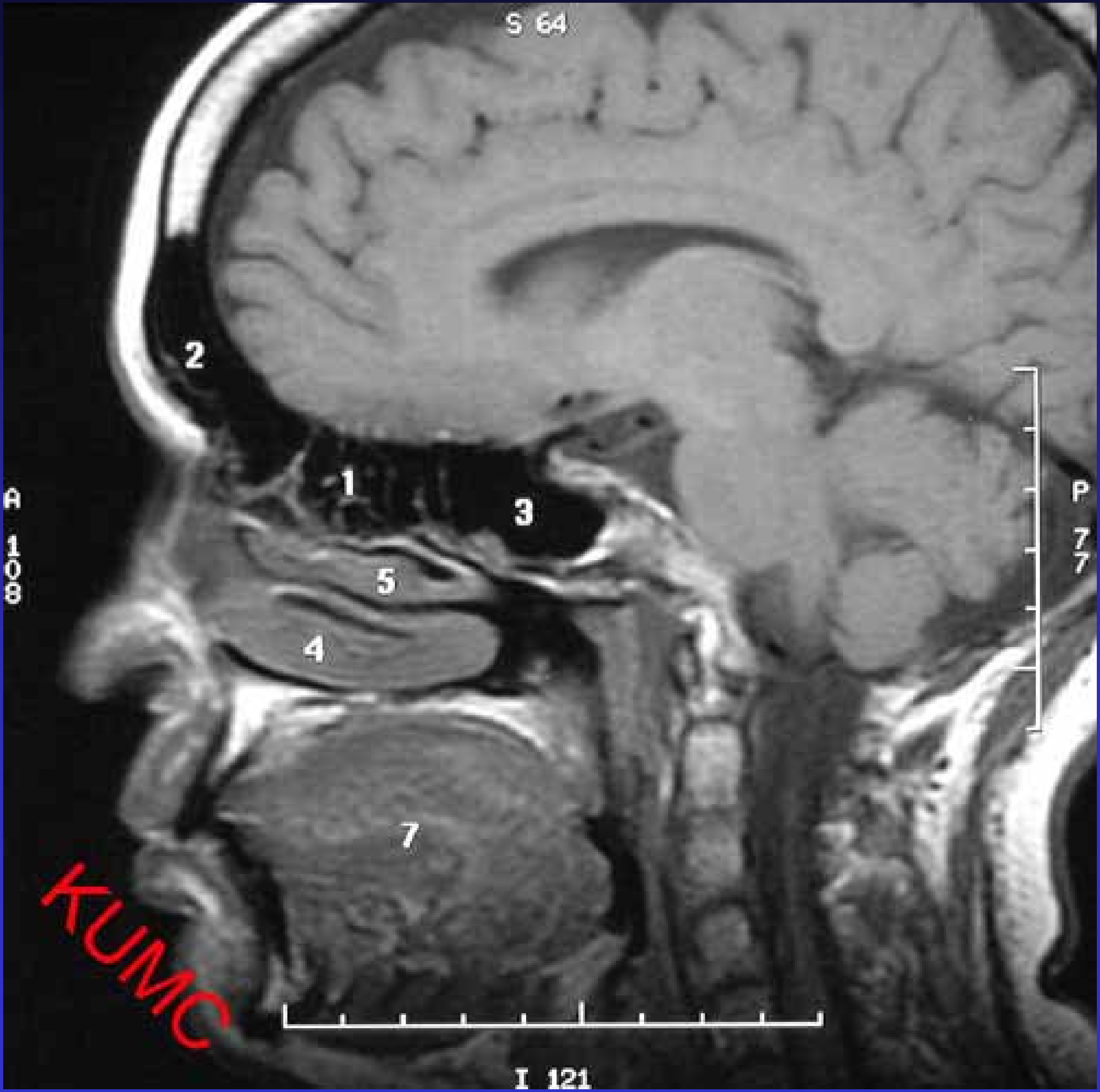
CT Angiogram



IMAGING MODALITIES

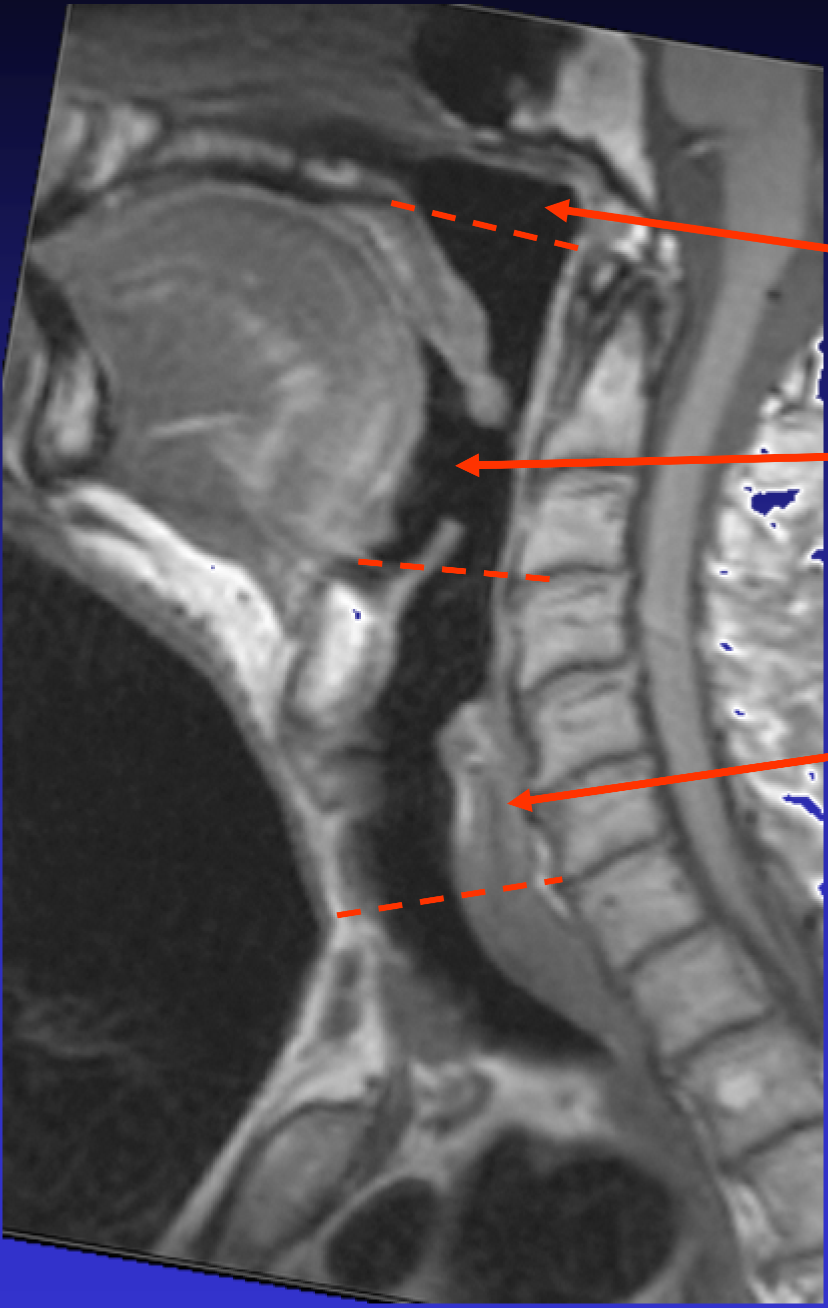
- Radiographs (Xray)
  - Include barium swallow
- Ultrasound
- Nuclear medicine
- Angiography
- Computed Tomography (CT)
  - CT angiography
- Magnetic Resonance Imaging (MRI)
  - MR angiography

Head/Face – MRI Sagittal



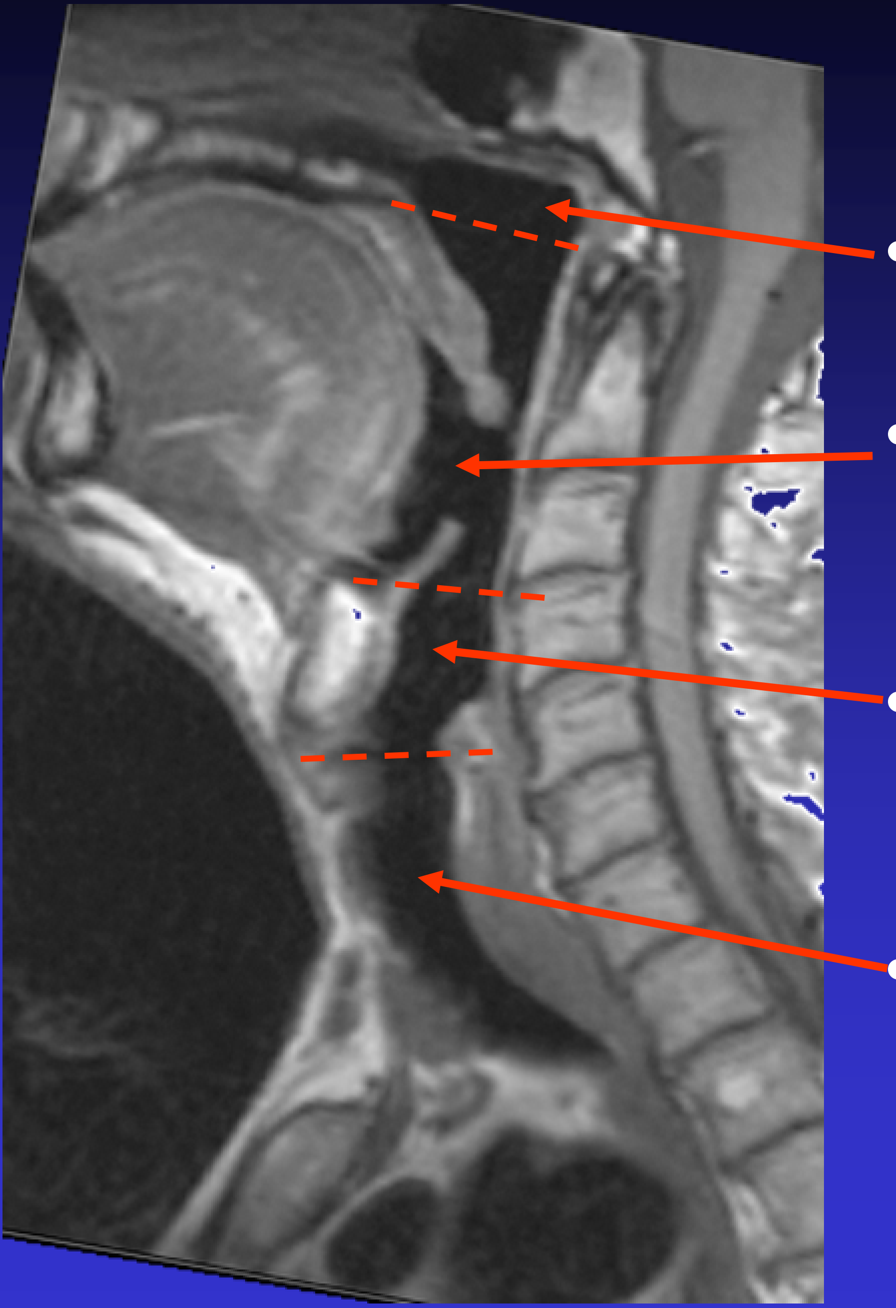
1. Ethmoid air cells
2. Frontal sinus
3. Sphenoid sinus
4. Inferior turbinate
5. Middle turbinate
7. Tongue

MRI Pharynx



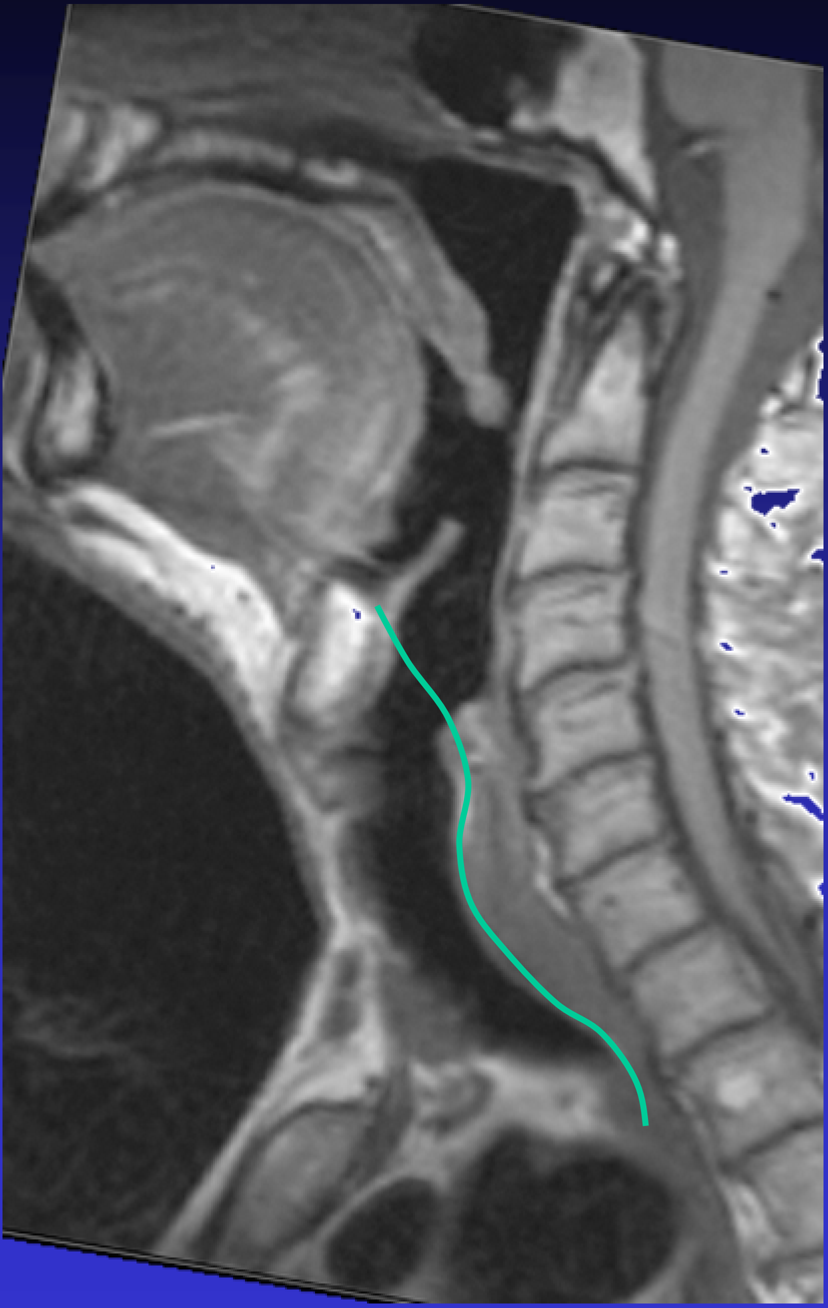
- Nasopharynx
  - Above hard palette
- Oropharynx
  - Below hard palette
  - Above valeculae
- Hypopharynx
  - Below valeculae
  - Above cricopharyngeus

MRI Airway

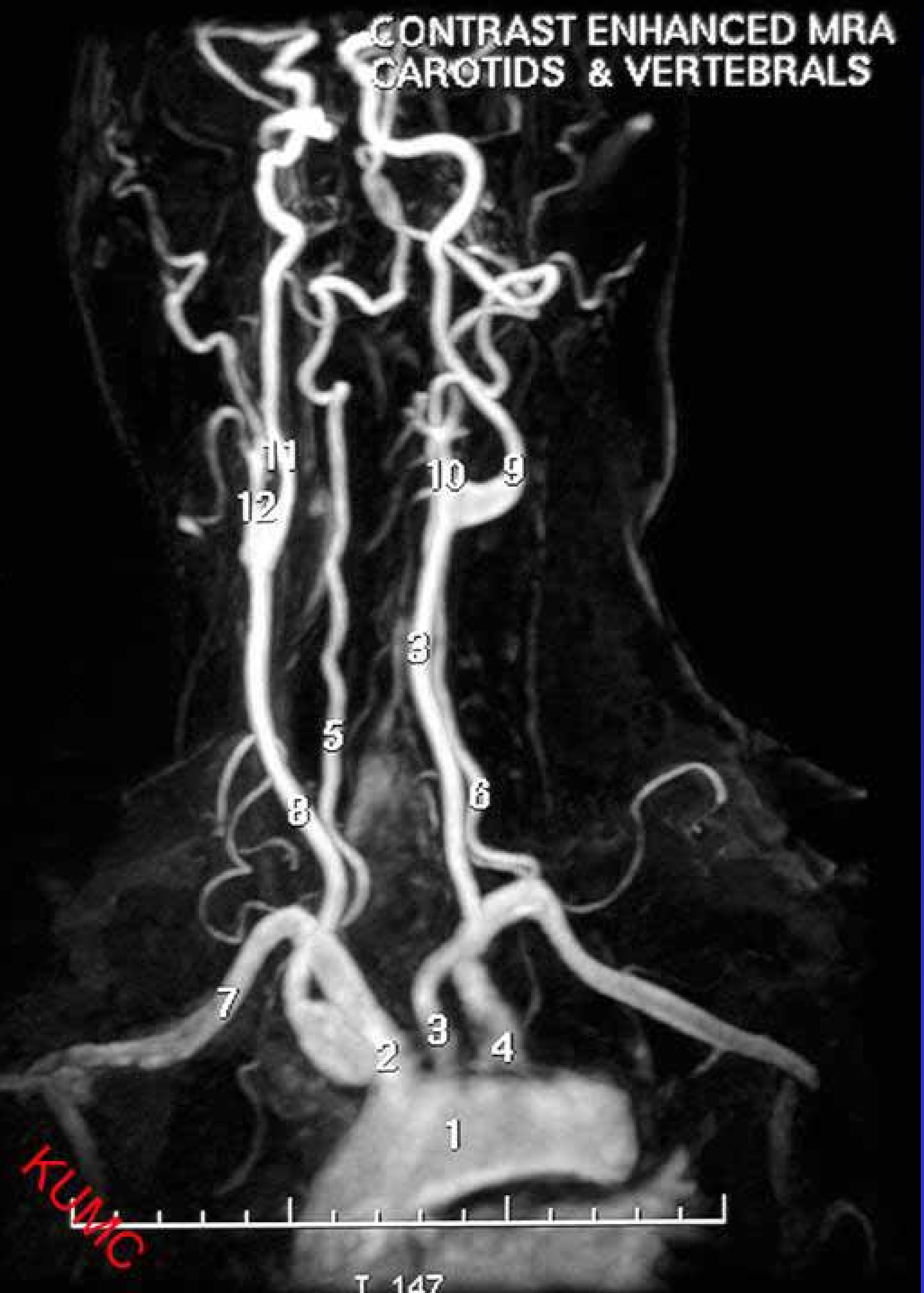


- Nasopharynx
  - Above hard palette
- Oropharynx
  - Below hard palette
  - Above valeculae
- Larynx
  - Below valeculae
  - Above vocal cords
- Trachea
  - Below vocal cords
  - Above carina

Airway / Pharynx Time Sharing



- Nasopharynx Oropharynx are COMMON to both
- Epiglottis is the ‘gateway’
- When open, functions as airway
  in front of the green line
- When closed, functions for swallowing
  behind the green line



1 Aortic arch

2 Brachiocephalic trunk (Rt)

3 Left common carotid

4 Left subclavian

5 Right vertebral

6 Left vertebral

7 Right subclavian

8 Right common carotid

9 Left internal carotid

10 Left external carotid

11 Right internal carotid

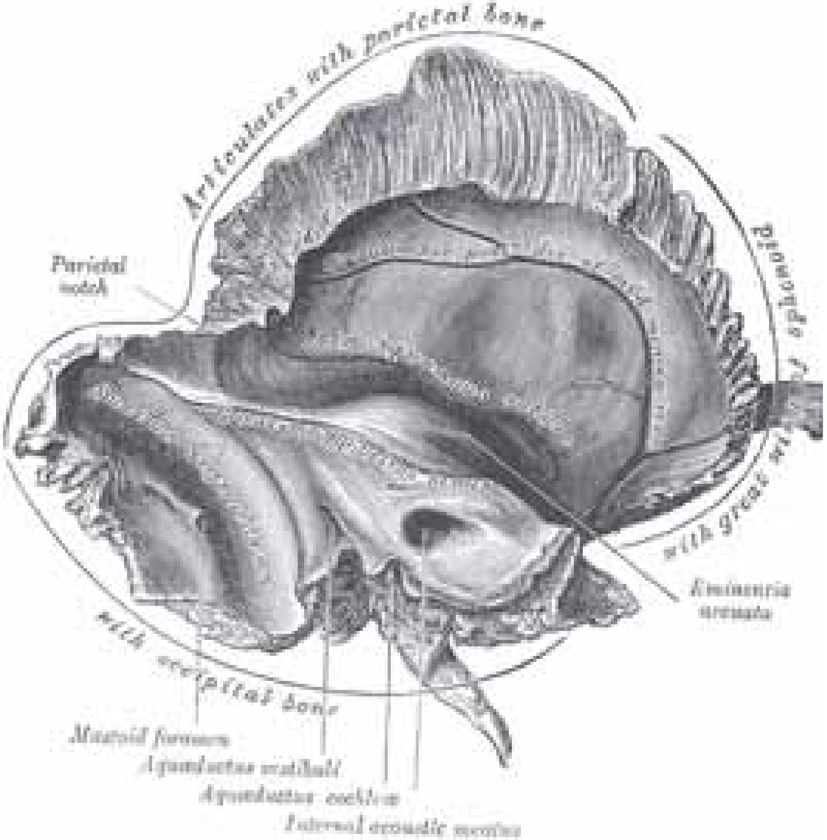
12 Right external carotid

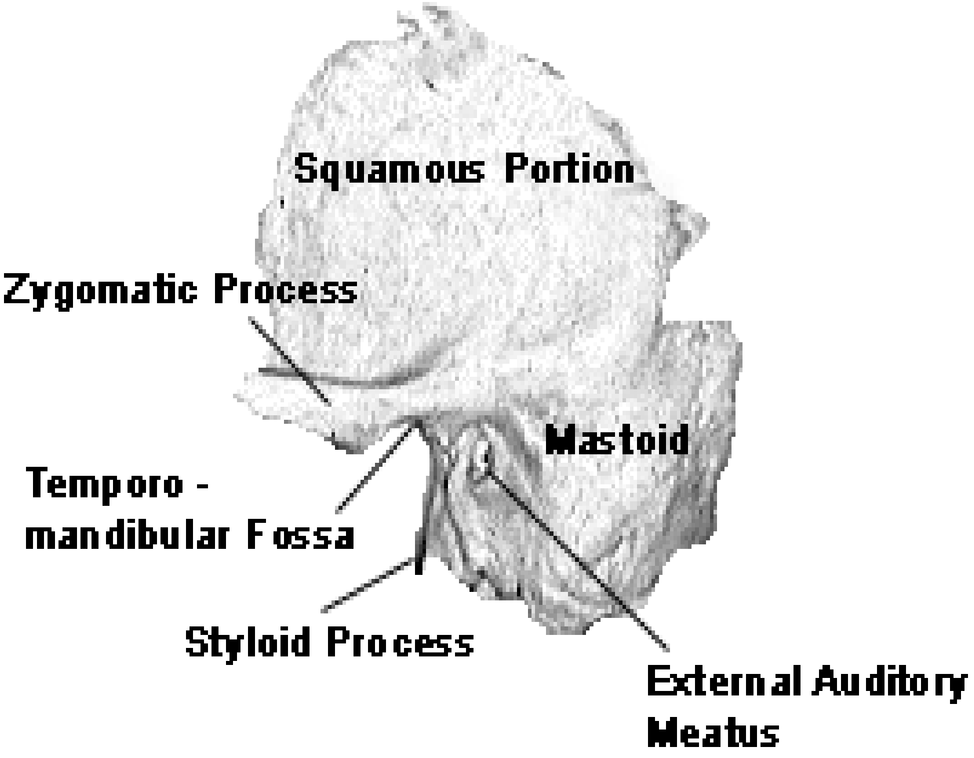
Specialized Imaging

- Temporal bone
  - CT mostly because very fine bone detail so important
- Sinuses
  - Mostly CT, coronal plane very helpful
- Temporomandibular joint
  - Mostly MRI, can do dynamic imaging
- Orbits
  - CT or MRI used about equally
  - Opthalmologists use ultrasound

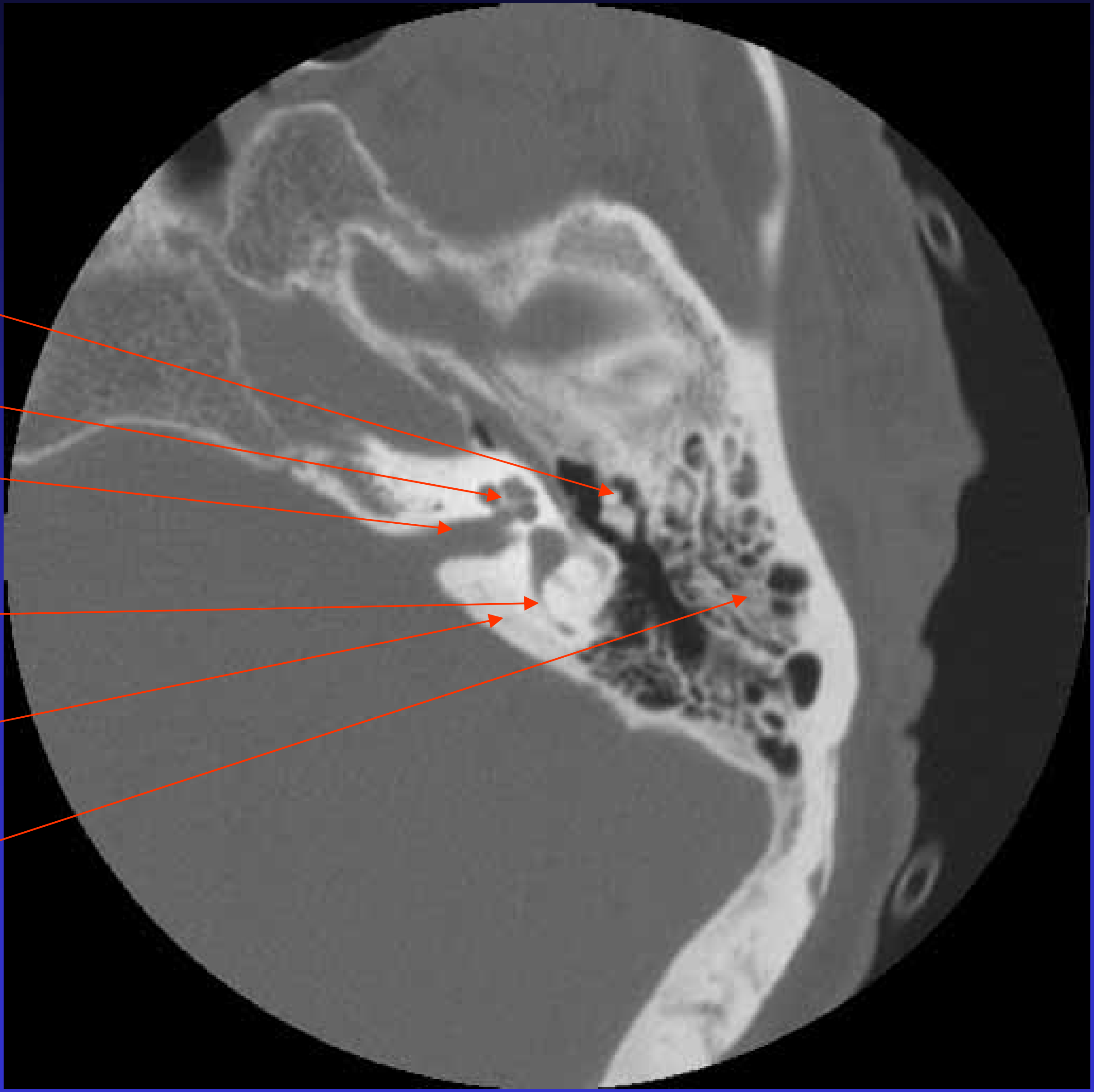
Temporal Bone

- Perhaps the most complex paired bone
- Sphenoid bone rivals temporal for intricacy
- Only bones that each contain 3 other bones





Temporal bone - CT



TRANSVERSE

Ossicles

Cochlea

Internal auditory canal

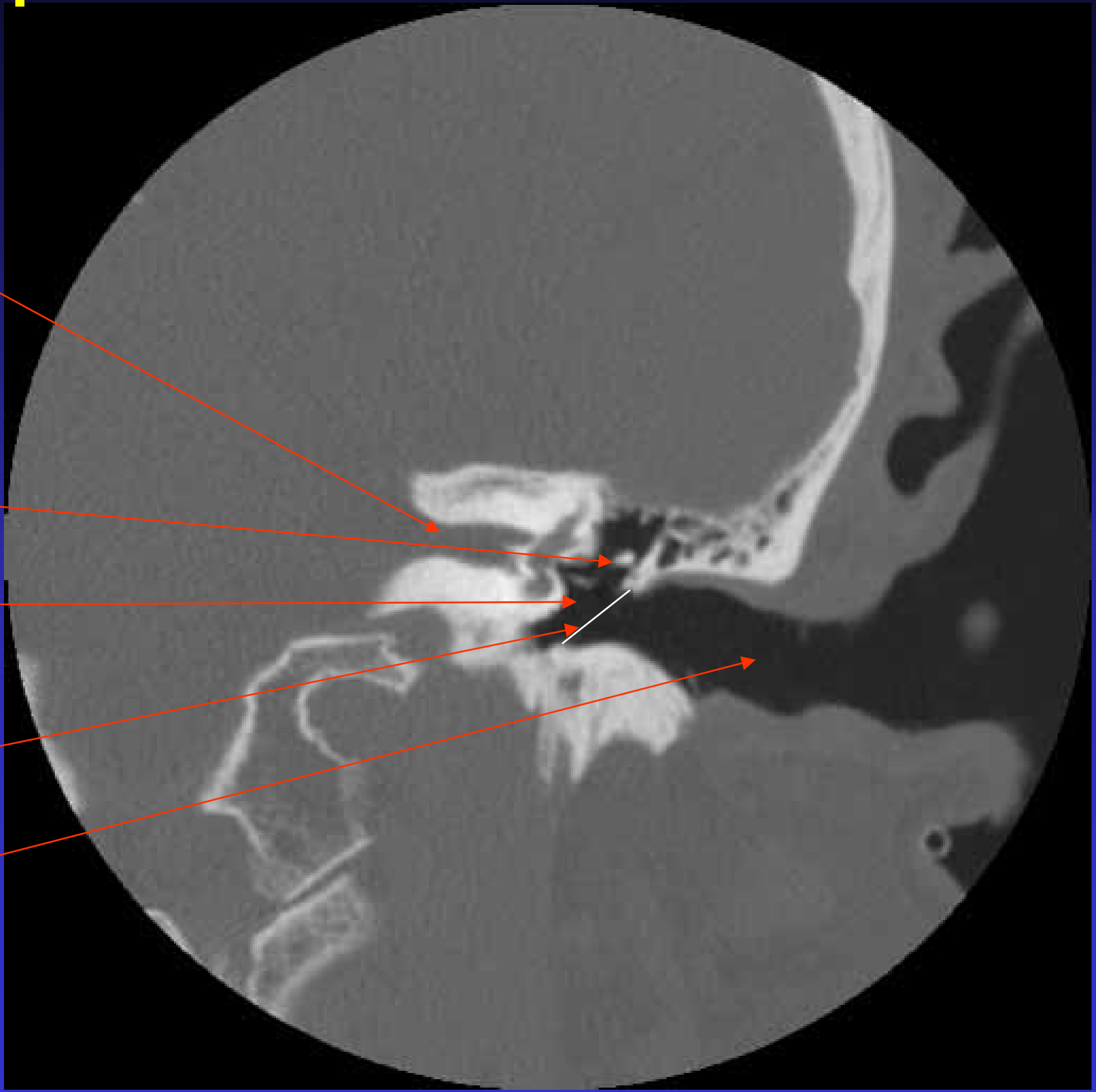
Semicircular canal

Petrous portion

Mastoid air cells

Temporal bone - CT

CORONAL



Internal auditory canal

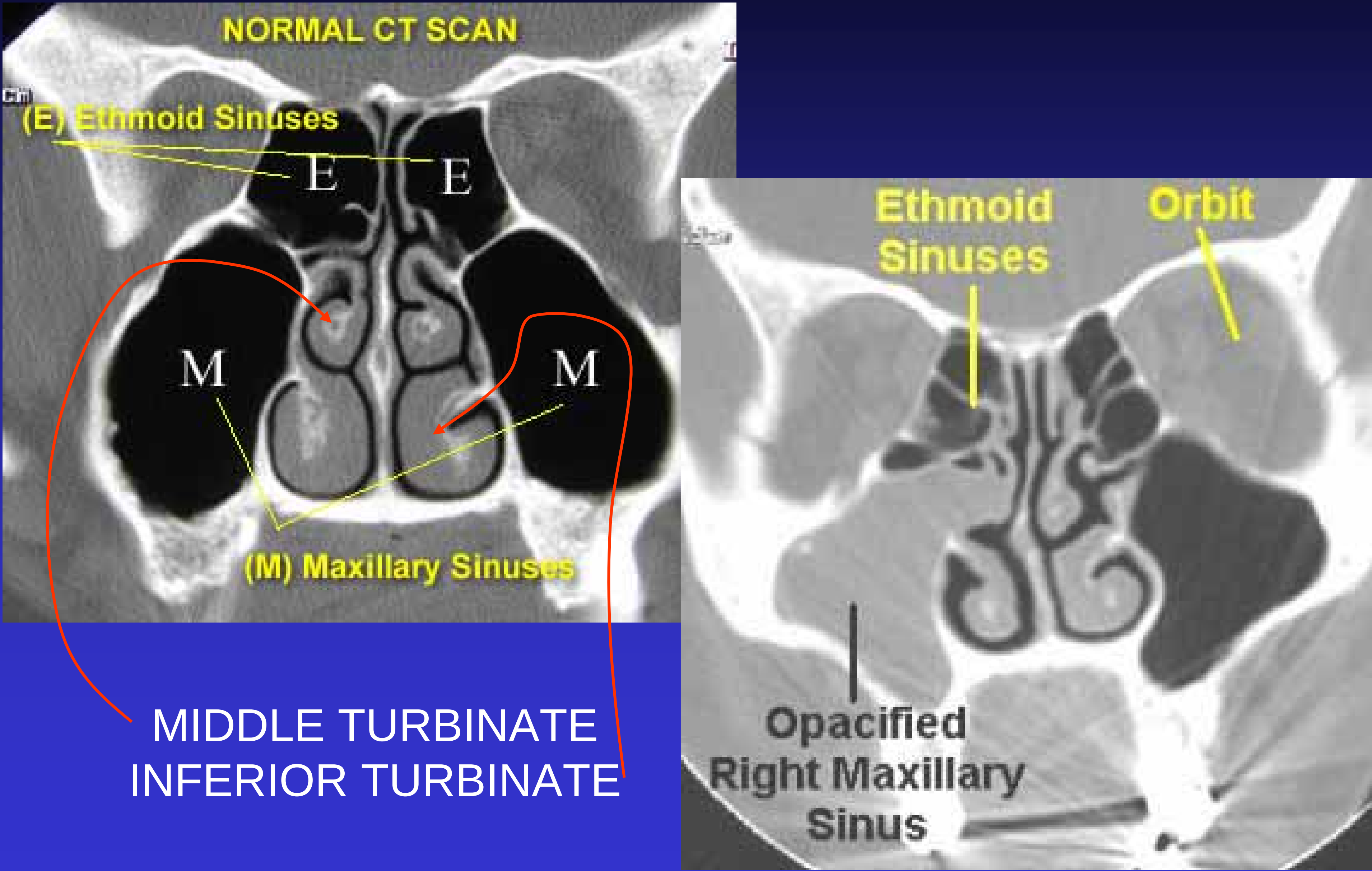
Ossicles

Inner ear

Tympanic membrane

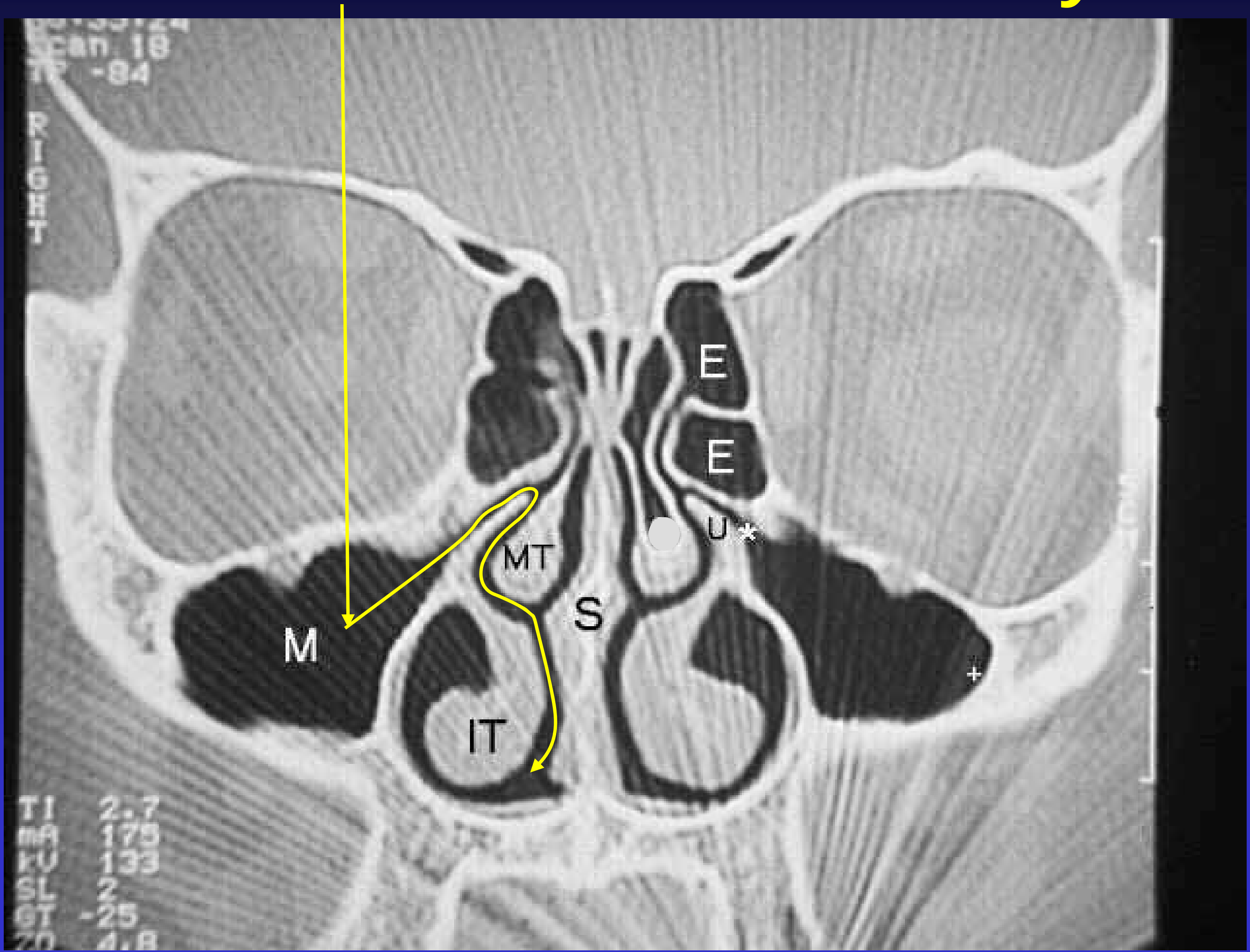
External auditory canal

Sinus CT Usually Coronal



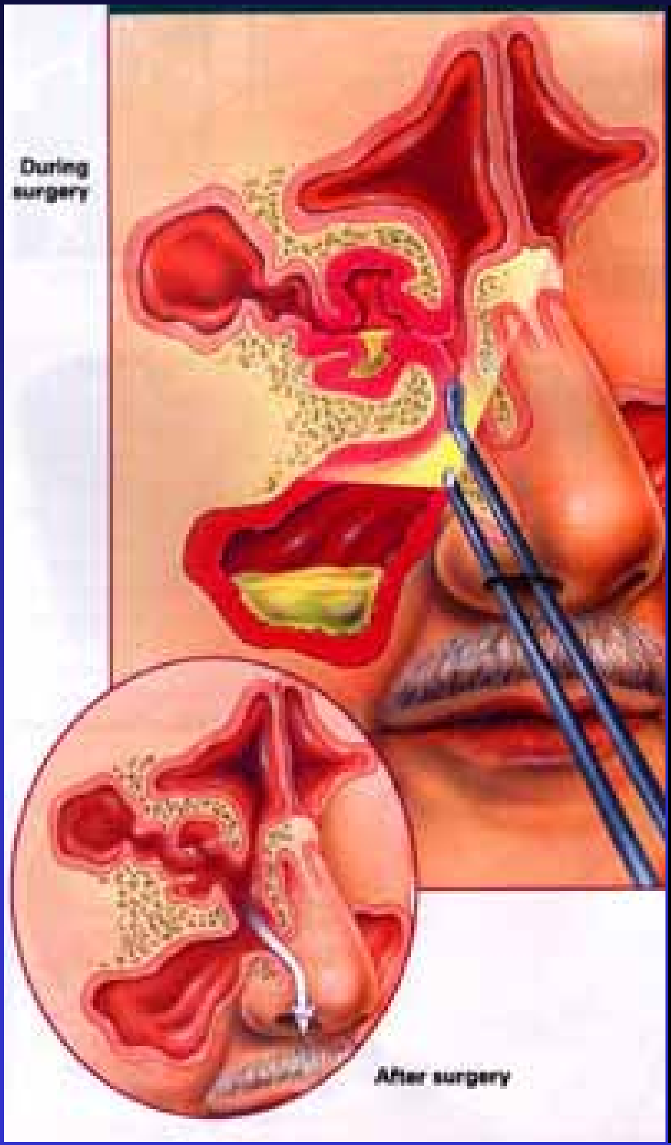
MIDDLE TURBINATE
INFERIOR TURBINATE

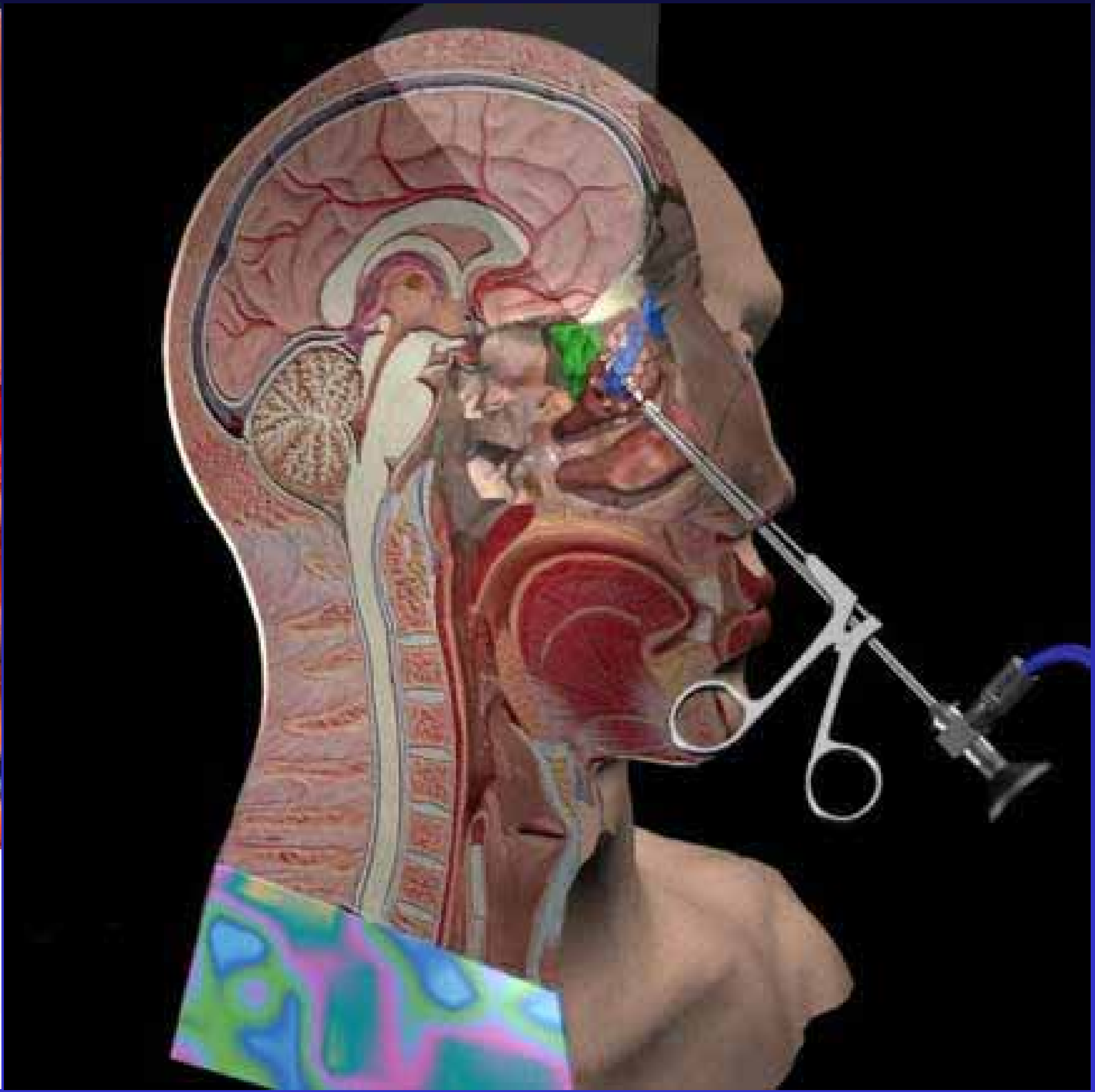
Sinus CT $$ Shot
Path out of Maxillary sinus



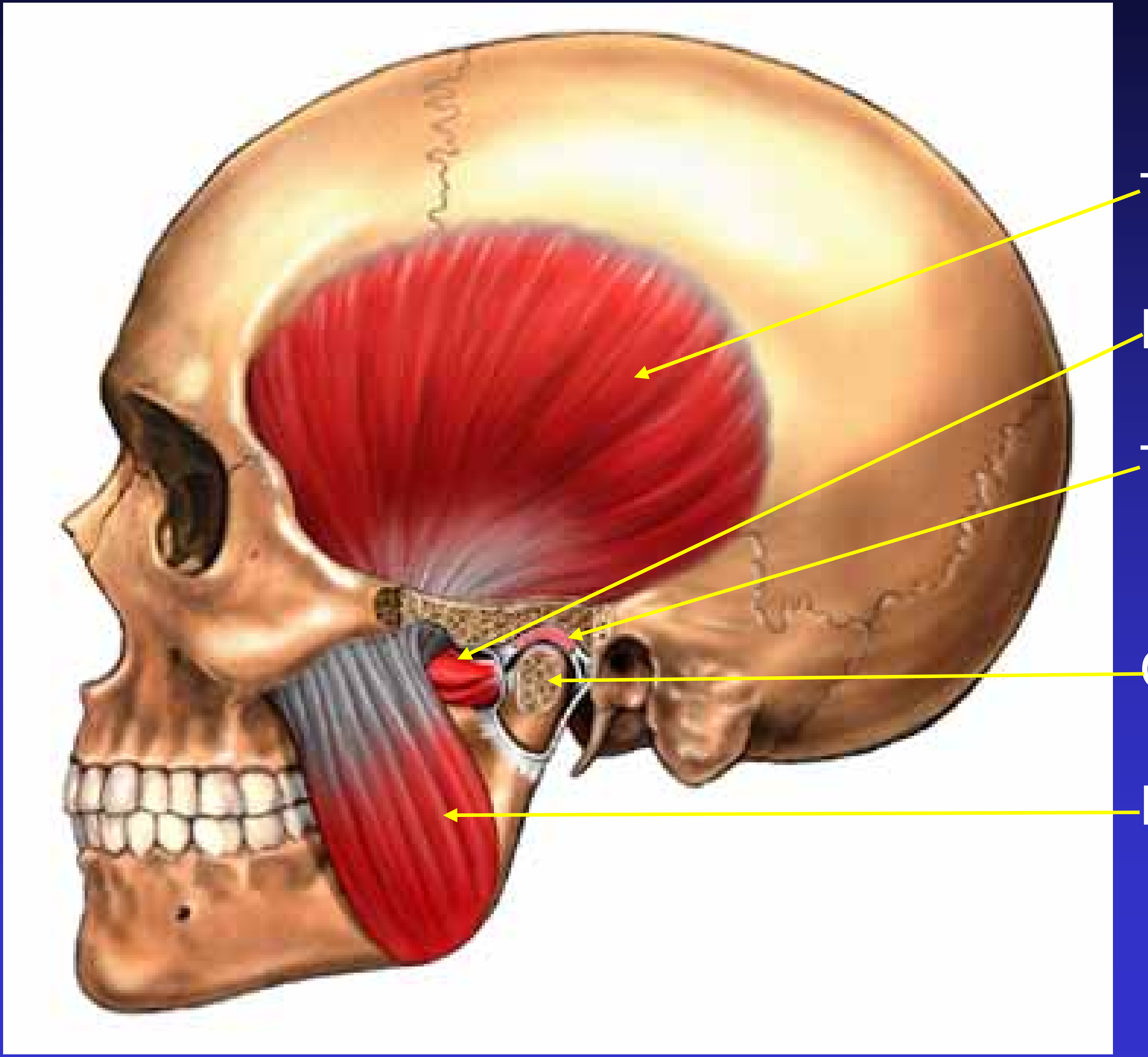
E=Ethmoid sinuses
M=Maxillary sinus
MT=Middle turbinate
IT=Inferior turbinate
S=Septum
U=Uncinate process
*= Ostium of Maxillary sinus

Endoscopic Sinus Surgery

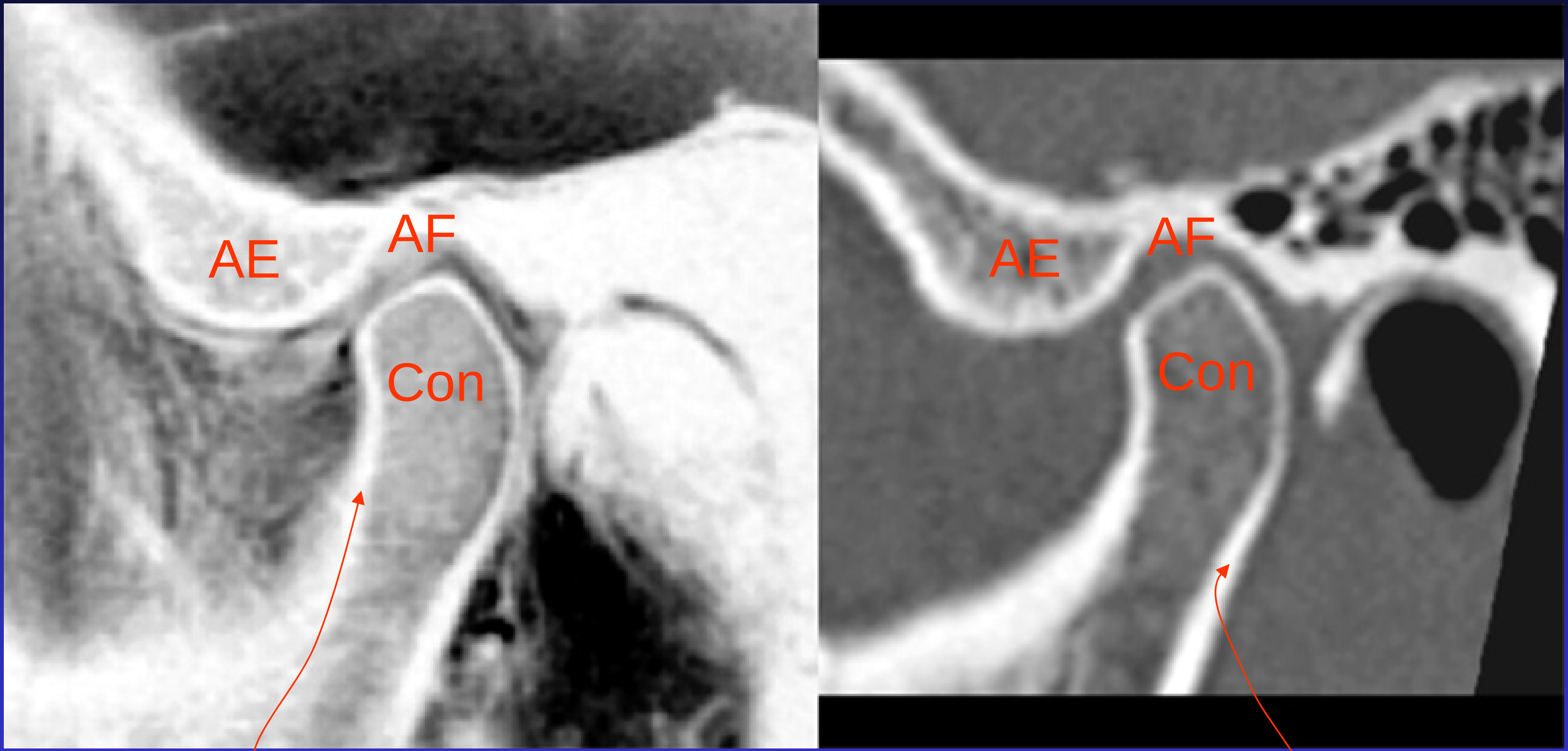




Temporomandibular Joint (TMJ)



TMJ – What Modality??



YOU KNOW THIS IS CT BECAUSE
CORTICAL BONE IS WHITE!

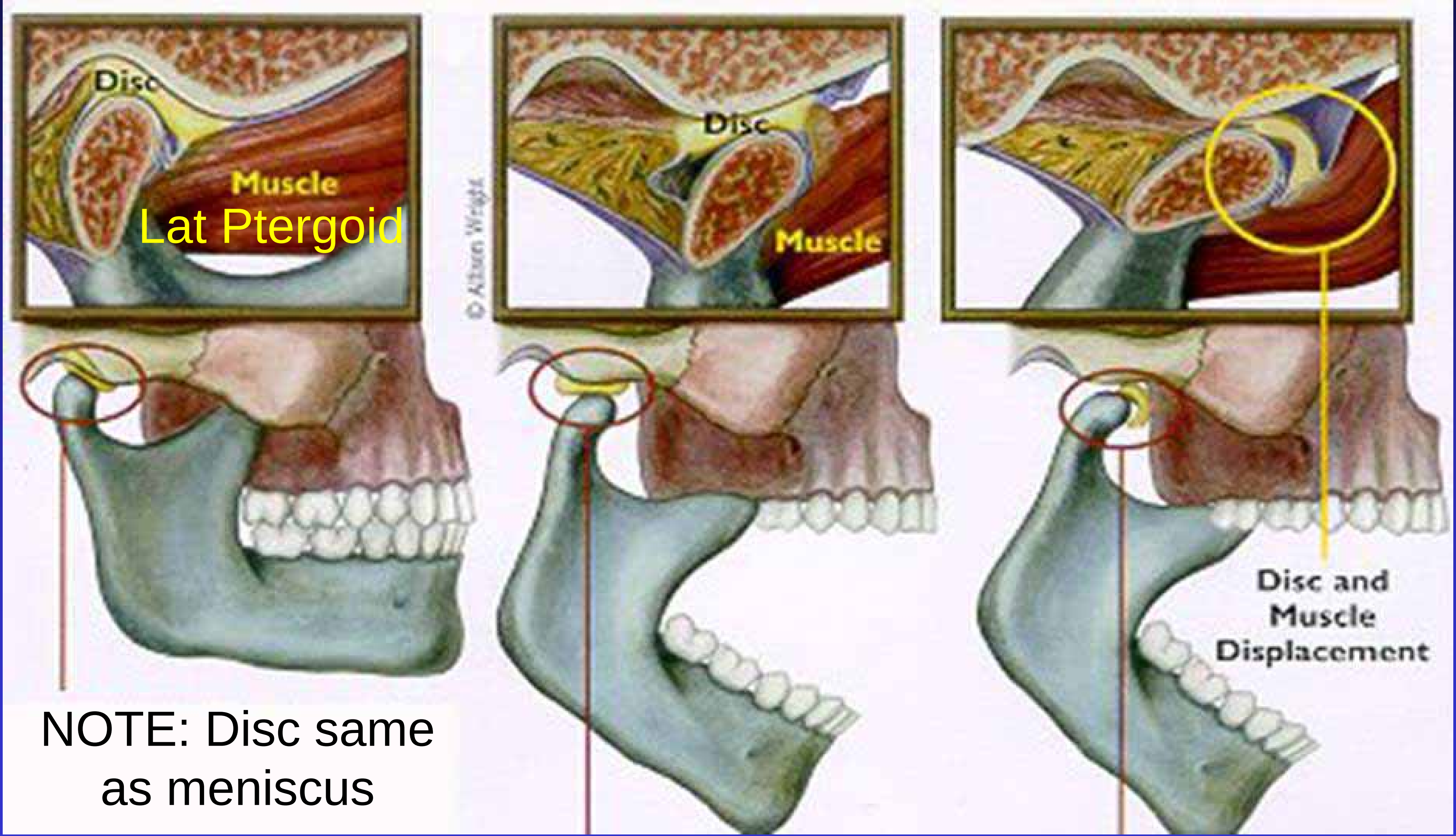
AE=Articular eminence, AF=Articular fossa, Con=Condyle

Normal - TMJ - Abnormal

JAW CLOSED

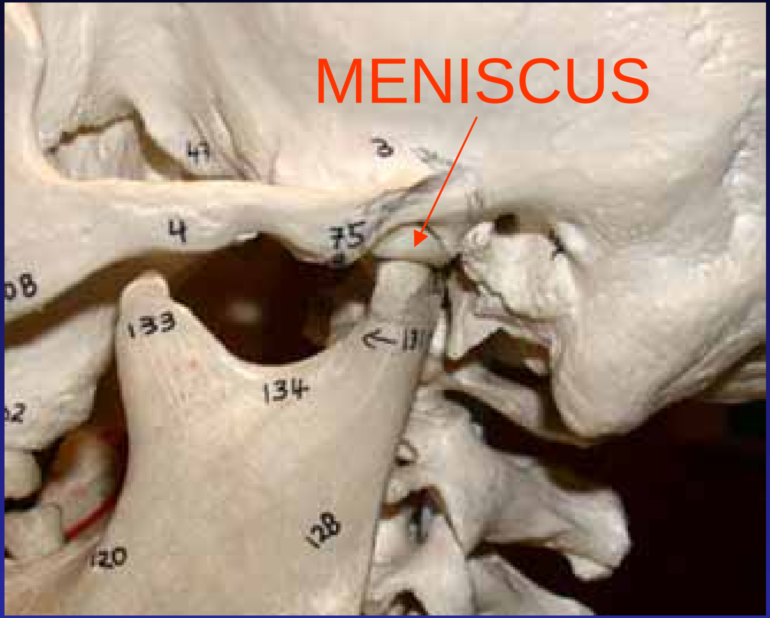
JAW OPEN

JAW OPEN

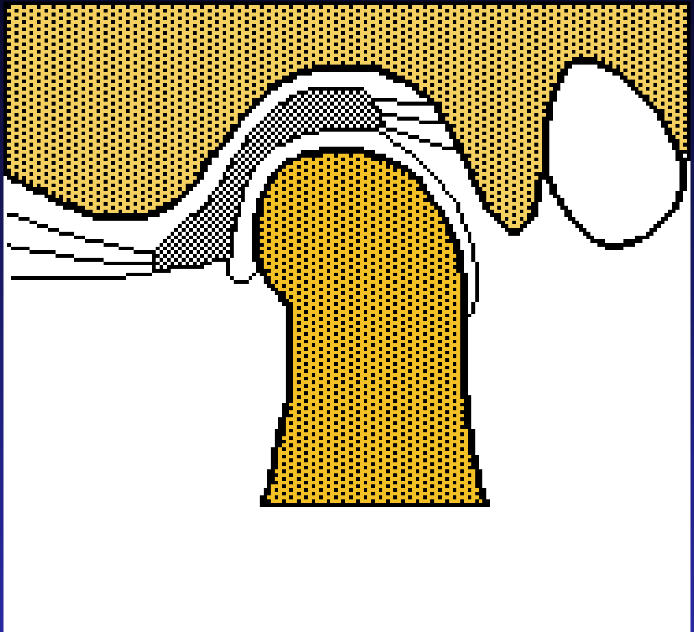


NOTE: Disc same as meniscus

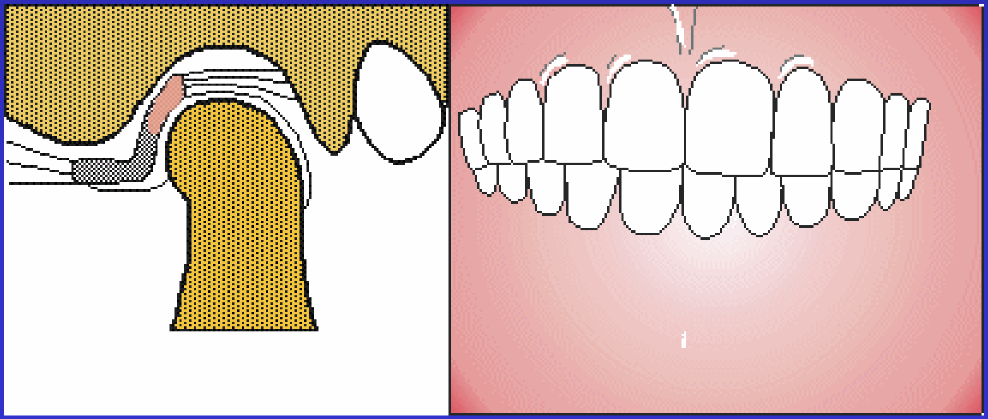
Temporomandibular Joint (TMJ)



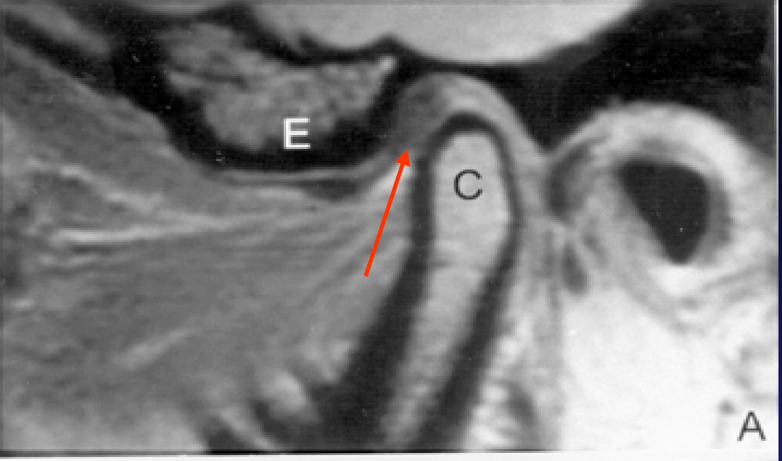
NORMAL



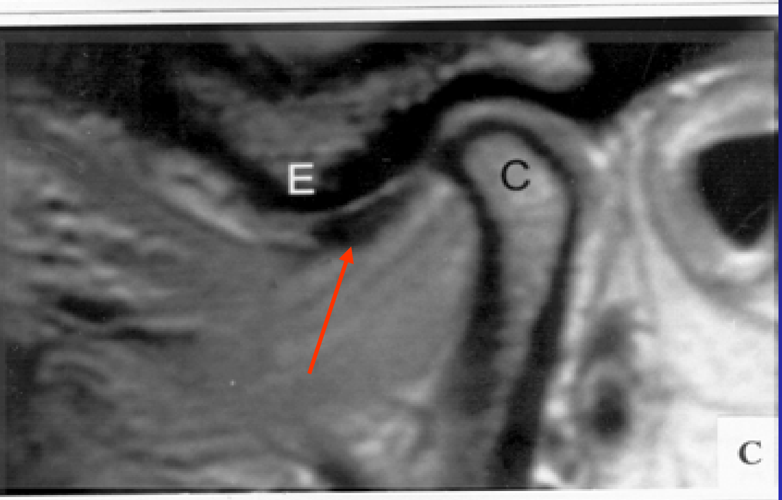
ABNORMAL



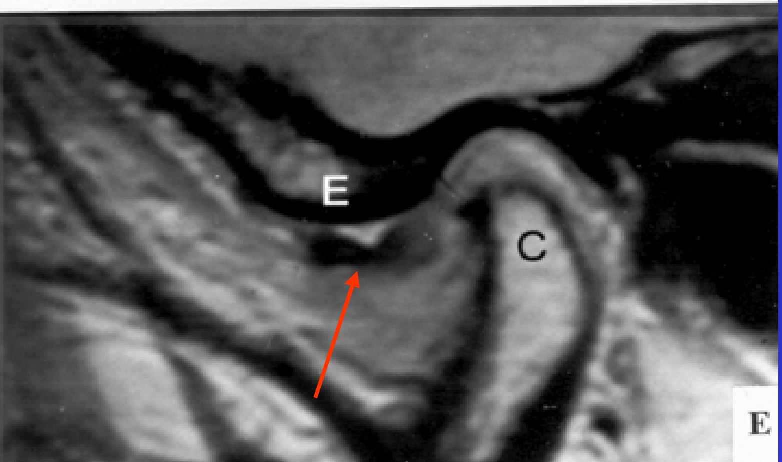
TMJ MRI
ALL CLOSED



NORMAL



DISPLACED
MENISCUS



DISPLACED
DAMAGED
MENSICUS

E=Articular Eminence

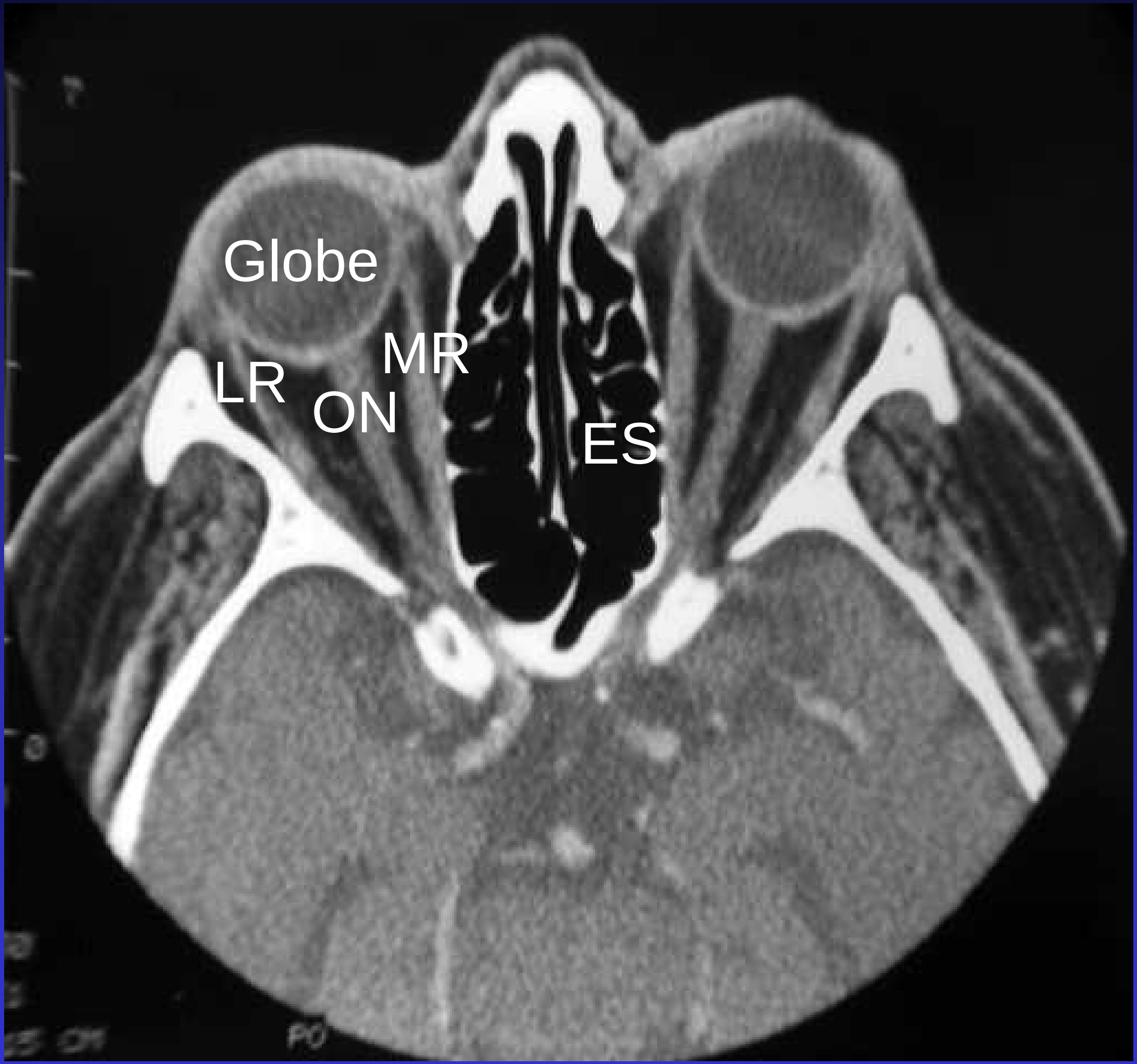
C=Condyle

Arrows point to meniscus in each image

Orbits

- CT
  - Trauma for sure
  - Very adequate for other problems though does irradiate the lens >> cataracts with high dose
- MRI
  - For visual problems, combine MRI of orbit with MRI of brain
  - Better than CT for soft tissue differences
- Ultrasound
  - Ophthalmologists use in offices / clinics

Orbits – CT Transverse



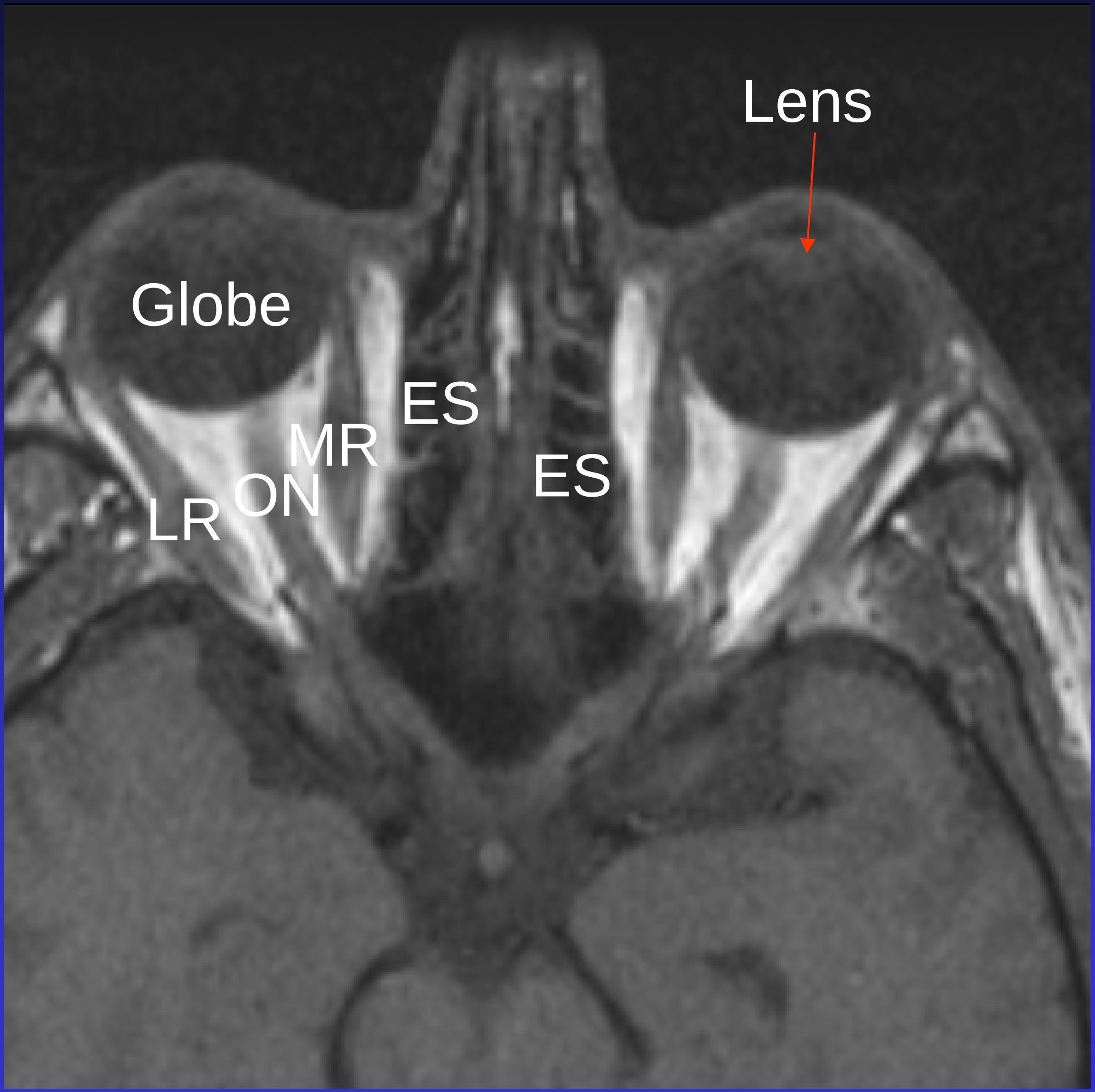
LR=Lateral rectus

MR=Medial rectus

ON=Optic nerve

ES=Ethmoid sinuses

Orbits – MRI Transverse



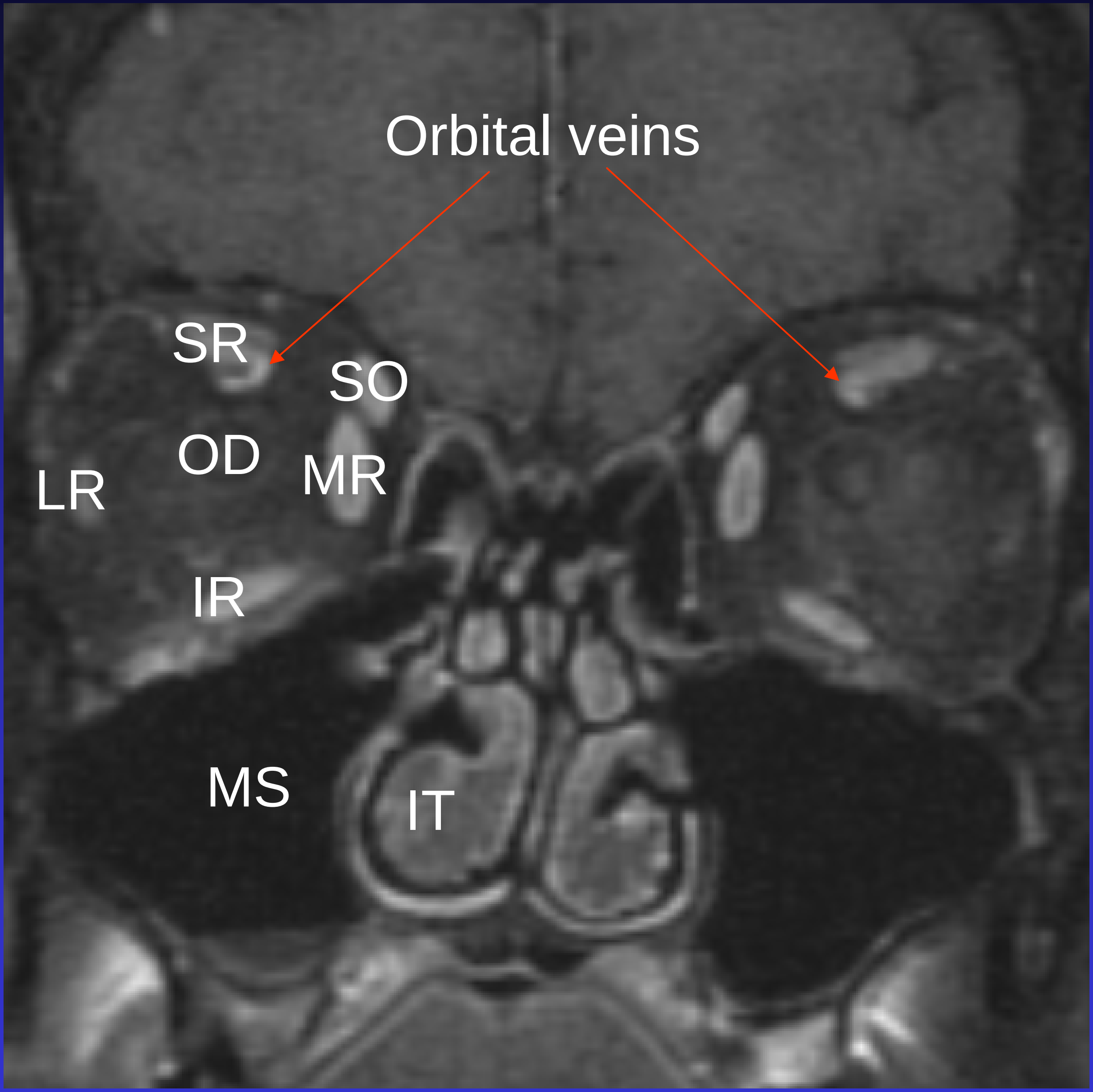
LR=Lateral rectus

MR=Medial rectus

ON=Optic nerve

ES=Ethmoid sinuses

Orbits – MRI Coronal



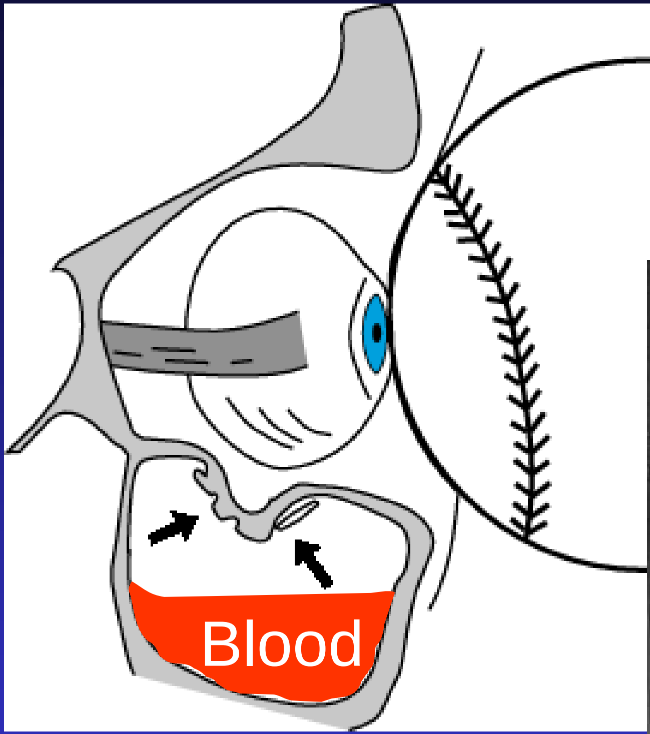
LR=Lateral rectus
MR=Medial rectus
MR=Inferior rectus
MR=Superior rectus
SO=Superior oblique

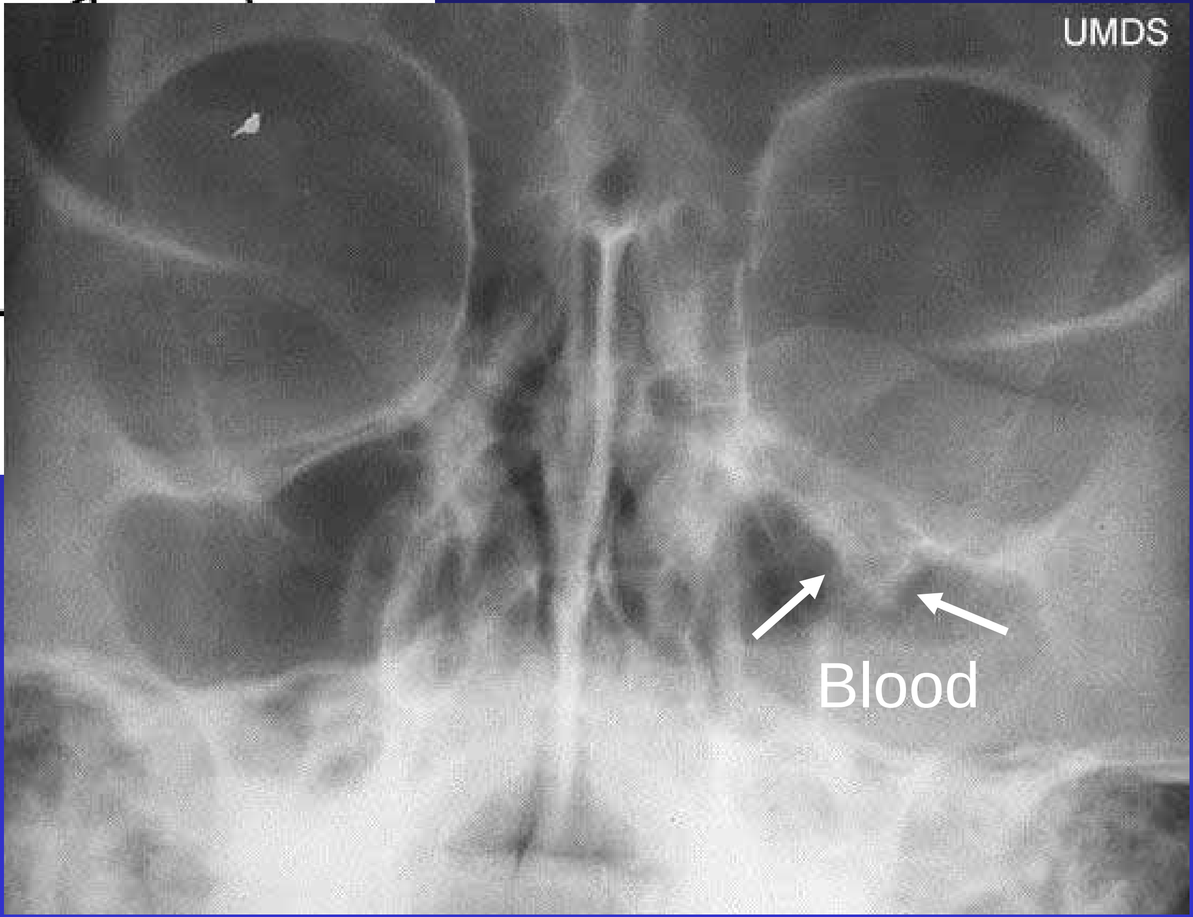
OD=Optic disc

MS=Maxillary
sinus

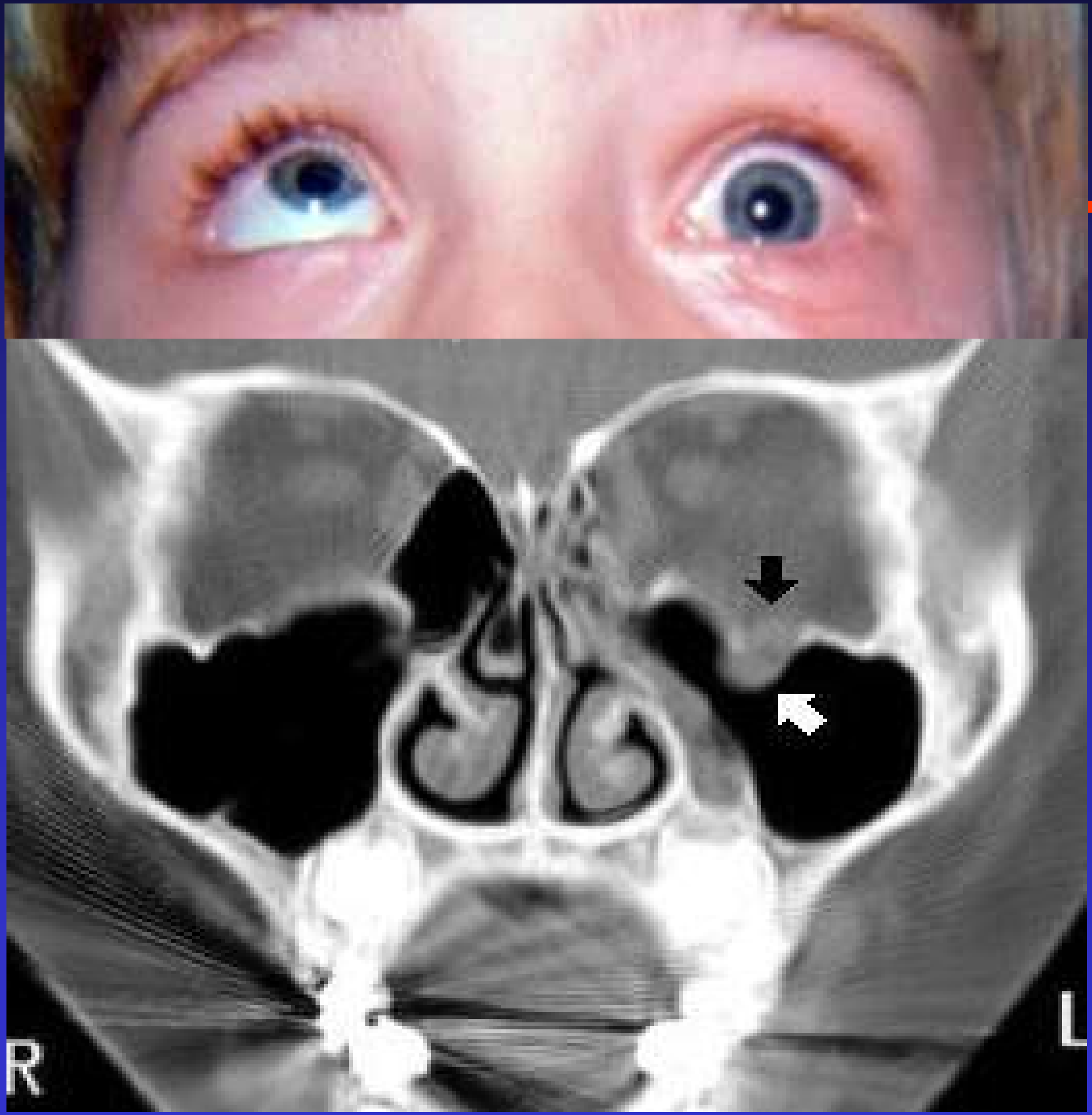
IT=Inferior turbinate

Orbital Floor Blowout Fracture



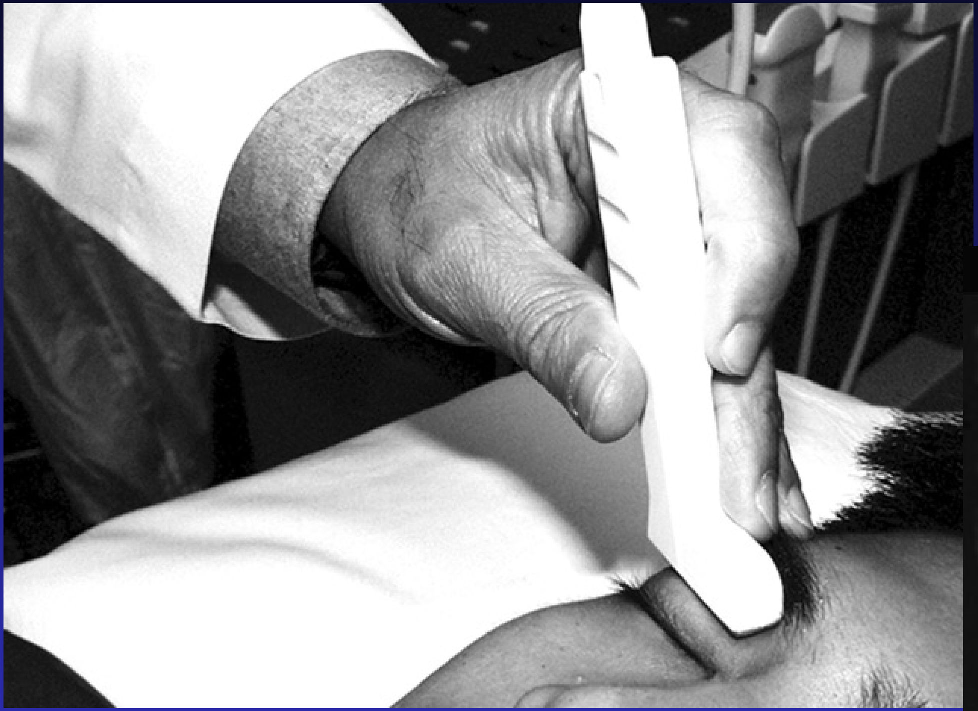


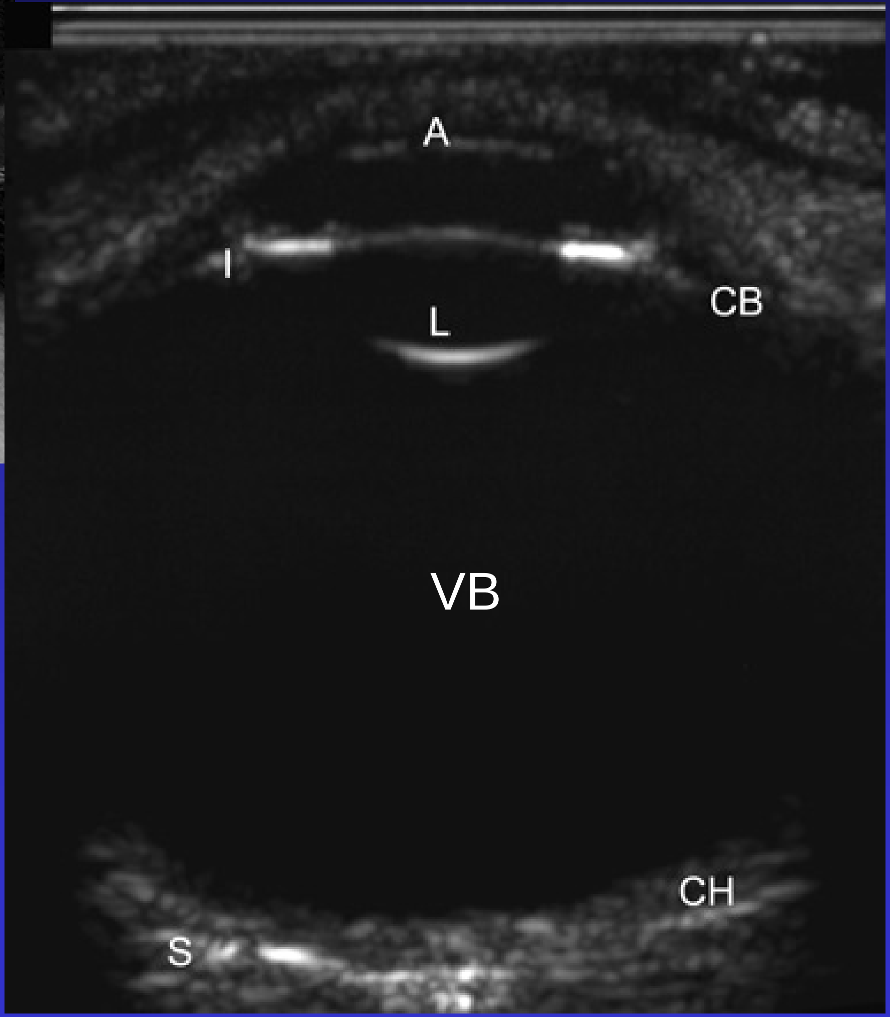
Left Orbital Floor
Blow-out Fracture



THE INFERIOR RECTUS MUSCLE IS TRAPPED IN THE FRACTURE SO PATIENT CAN NOT LOOK UP

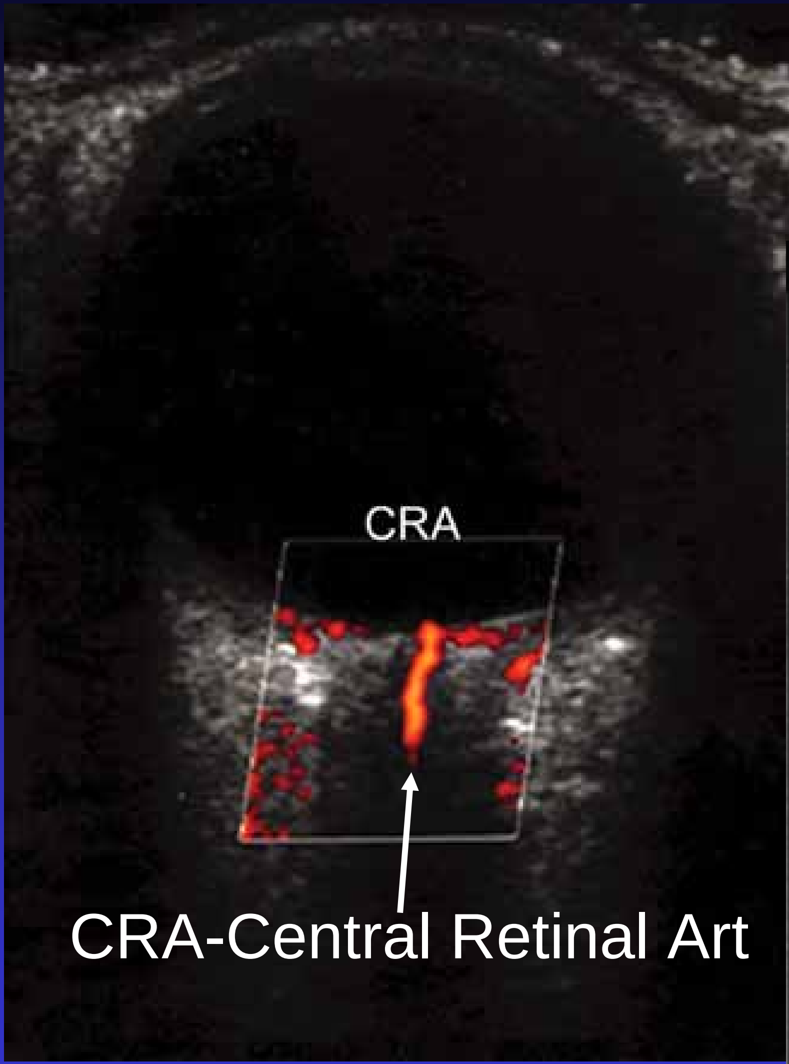
Orbital Ultrasound

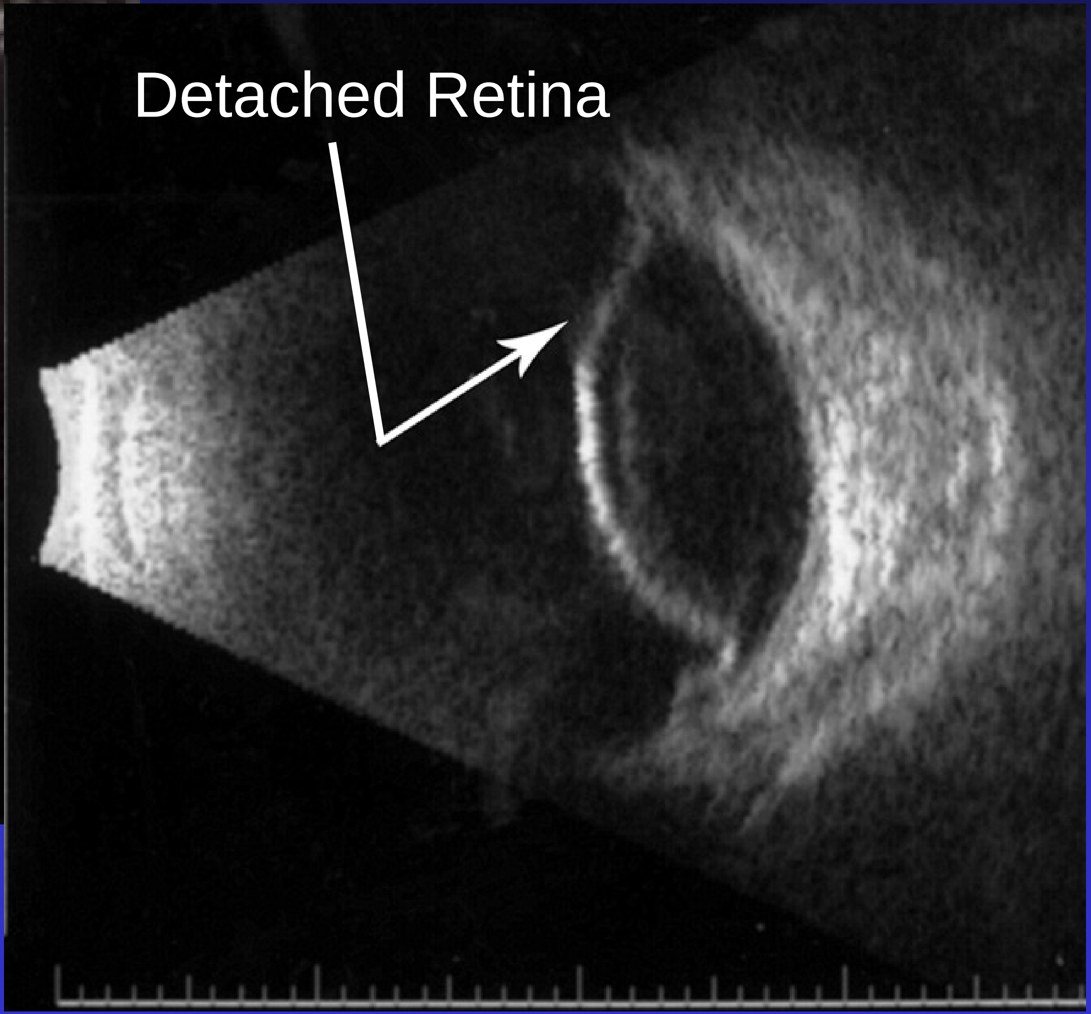




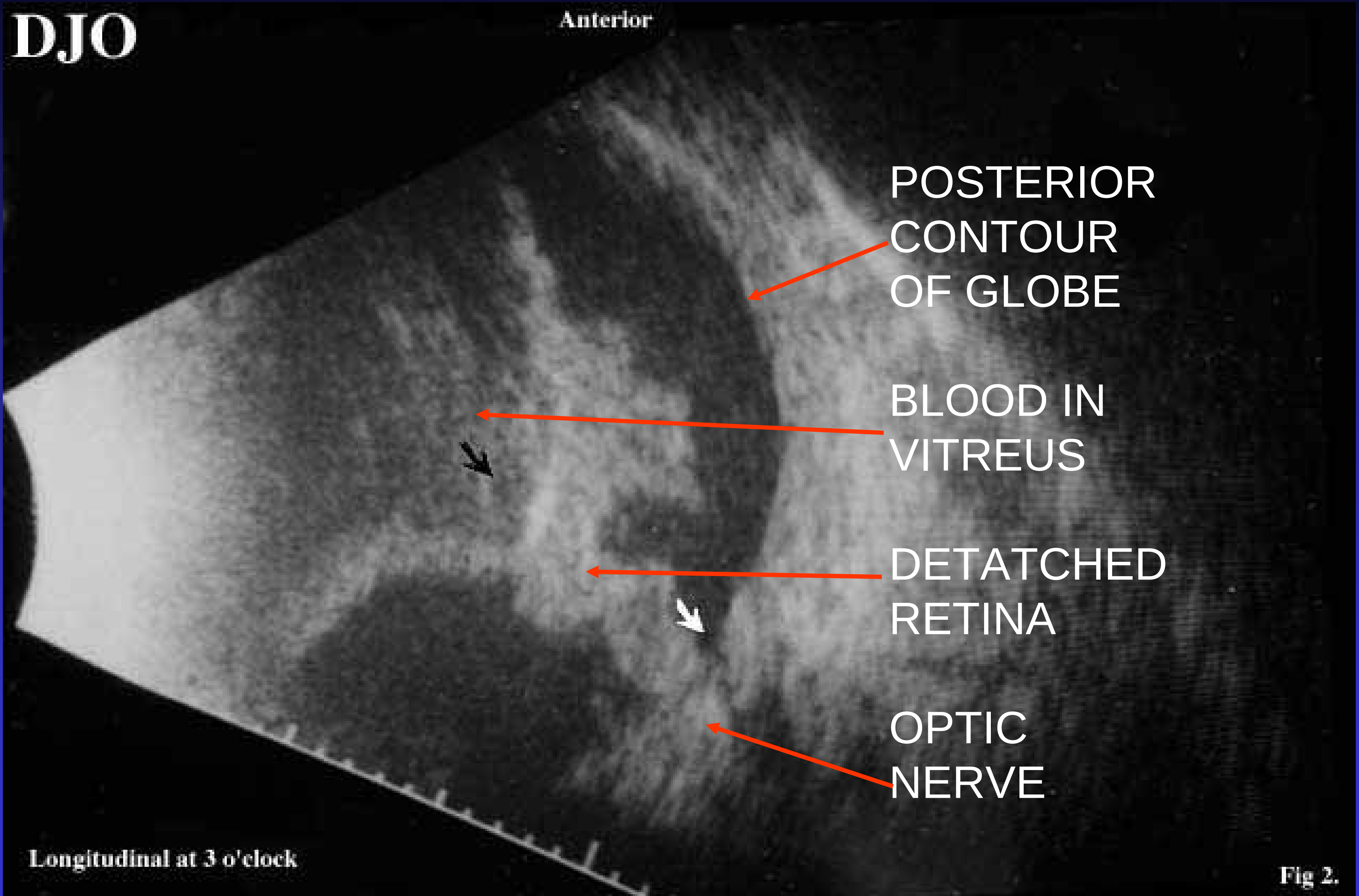
A-Anterior Chamber
I-Iris
L-Lens
CB-Ciliary Body
VB-Vitreous Body
CH-Choroid
S-Sclera

Orbital Ultrasound





Orbital Ultrasound



POSTERIOR CONTOUR OF GLOBE

BLOOD IN VITREUS

DETATCHED RETINA

OPTIC NERVE